COMPARISON OF LEG WRAPPING VERSUS LEG ELEVATON FOR PREVENTION OF HYPOTENSION IN SPINAL ANAESTHESIA FOR ELECTIVE CAESAREAN SECTION

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IN

ANAESTHESIOLOGY

BRANCH X

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THANJAVUR MEDICAL COLLEGE

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CERTIFICATE

This is to certify that the dissertation entitled, "COMPARISON OF LEG WRAPPING VERSUS LEG ELEVATION FOR PREVENTION OF HYPOTENSION IN SPINAL ANAESTHESIA FOR ELECTIVE CAESEREAN SECTION" is a bonafide original work of **Dr. N.SARANYA DEVI** in partial fulfilment of the requirements for the **Doctor of Medicine in Anaesthesiology - Branch X** examination of the Tamilnadu Dr.M.G.R. Medical University, Chennai to be held in APRIL 2016. The period of study was from September 2013 to July 2015.

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DECLARATION

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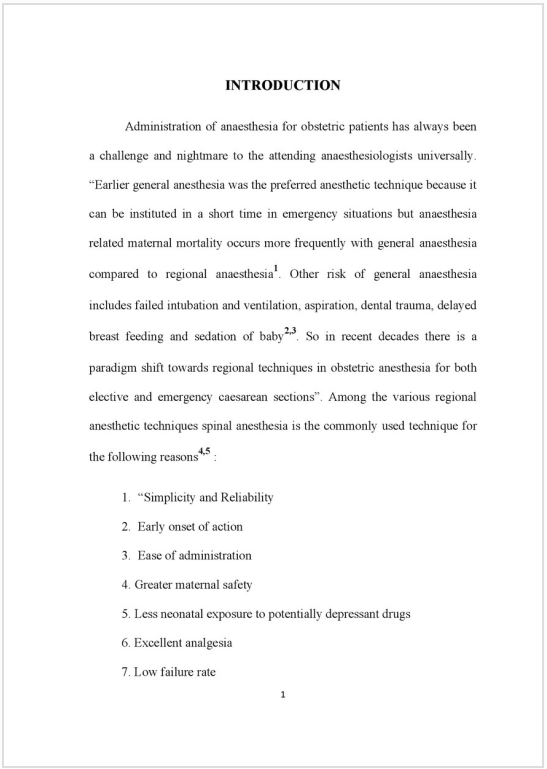

INTRODUCTION

Administration of anaesthesia for obstetric patients has always been a challenge and nightmare to the attending anaesthesiologists universally. "Earlier general anesthesia was the preferred anesthetic technique because it can be instituted in a short time in emergency situations but anaesthesia related maternal mortality occurs more frequently with general anaesthesia compared to regional anaesthesia[1]. Other risk of general anaesthesia includes failed intubation and ventilation, aspiration, dental trauma, delayed breast feeding and sedation of baby[2,3]. So in recent decades there is a paradigm shift towards regional techniques in obstetric anesthesia for both elective and emergency caesarean sections". Among the various regional anesthetic techniques spinal anesthesia is the commonly used technique for the following reasons[4,5] :

1. "Simplicity and Reliability
2. Early onset of action
3. Ease of administration
4. Greater maternal safety
5. Less neonatal exposure to potentially depressant drugs
6. Excellent analgesia
7. Low failure rate

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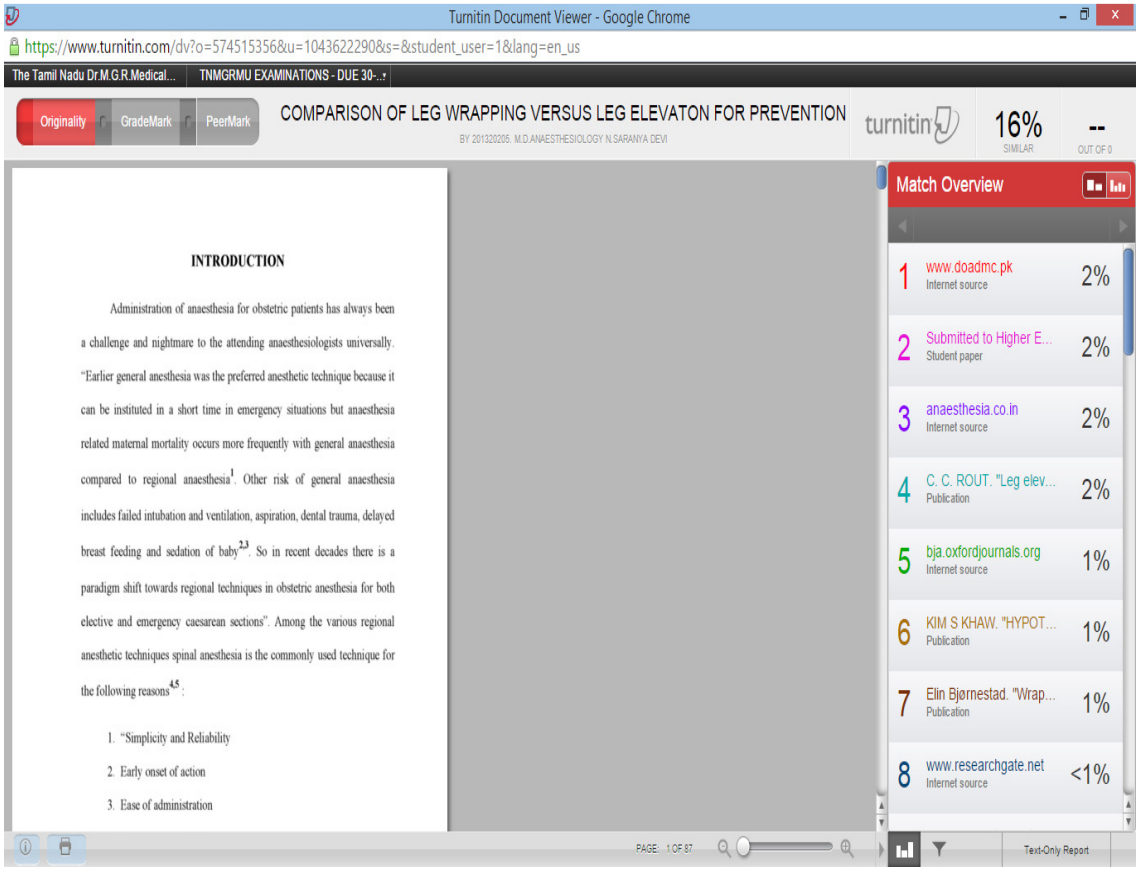
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CONTENTS

ABBREVATIONS

BC	CONTROL GROUP
BLE	LEG ELEVATION GROUP
BLW	LEG WRAPPING GROUP
CNS	CENTRAL NERVOUS SYSTEM
CSF	CEREBROSPINAL FLUID
cm	CENTIMETER
DBP	DIASTOLIC BLOOD PRESSURE
gm	GRAM
HR	HEART RATE
MAP	MEAN ARTERIAL PRESSURE
MINS	MINUTES
MSAP	MEAN SYSTOLIC ARTERIAL PRESSURE
mEq	MILLIEQUIVALENTS
mmHg	MILLIMETER OF MERCURY
mg	MILLIGRAM
ml	MILLILITRE
µg	MICROGRAM
Kg	KILOGRAM
SAP	SYSTOLIC ARTERIAL PRESSURE
SCD	SEQUENTIAL COMPRESSION DEVICE

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INTRODUCTION

Administration of anaesthesia for obstetric patients has always been a challenge and nightmare to the attending anaesthesiologists universally. Earlier general anesthesia was the preferred anesthetic technique because it can be instituted in a short time in emergency situations but anaesthesia related maternal mortality occurs more frequently with general anaesthesia compared to regional anaesthesia[1]. Other risk of general anaesthesia includes failed intubation and ventilation, aspiration, dental trauma, delayed breast feeding and sedation of baby[2,3]. So in recent decades there is a paradigm shift towards regional techniques in obstetric anesthesia for both elective and emergency caesarean sections. Among the various regional anesthetic techniques spinal anesthesia is the commonly used technique for the following reasons[4,5] :

1. Simplicity and Reliability
2. Early onset of action
3. Ease of administration
4. Greater maternal safety
5. Less neonatal exposure to potentially depressant drugs
6. Excellent analgesia
7. Low failure rate

8. Minimal dose of local anaesthetic agent (no risk of toxicity)

9. Mother can remain awake and experience child birth

10. Dense blockade

The choice of local anaesthetic is determined by the quality of block required and the duration of surgery. In the early 1950s lignocaine the first amide local anaesthetic agent came into clinical use. Since its introduction into clinical practice lignocaine was extensively used for spinal anaesthesia. Lignocaine is not being used any more in spinal anaesthesia due to transient neurological symptoms. Bupivacaine, the first long acting amide local anaesthetic is the most commonly used local anaesthetic drug till now.

Spinal blockade up to T4 is necessary to provide adequate anaesthesia for caesarean section[6]. Hypotension due to sympathetic blockade is inevitable in spinal anaesthesia. Prevention of hypotension due to spinal anaesthesia for elective caesarean section has been referred as the "Holy Grail" in obstetric anaesthesia[7,8]. In spite of enormous development in anaesthetic drugs and techniques, hypotension during spinal anaesthesia is still a major problem. Hypotension is defined as a 20% decrease in systolic blood pressure from baseline or systolic blood pressure < 90mmHg[9]. Hypotension results in dizziness, nausea and vomiting which makes the experience uncomfortable for the mother.

In severe cases neuraxial block induced hypotension can result in unconsciousness, pulmonary aspiration, apnoea and even cardiac arrest. Sustained hypotension can impair uteroplacental perfusion and thus may induce foetal hypoxia and acidosis[10].

Numerous studies have been conducted to find out the ideal method for prevention of spinal hypotension. Different available techniques which are in use include fluid transfusion, pre-emptive and intraoperative vasopressor usage and physical methods. Fluids either crystalloid or colloid were used to increase intravascular volume and to prevent hypotension. Though this is simple and easy technique this cannot be used in gestational hypertension and cardiac patients[11]. Colloids use is associated with risk of allergic reactions and anaphylaxis. The role of preloading and coloading in prevention of spinal hypotension has become doubtful now.[12] Pre-emptive and intraoperative ephedrine usage is associated with risk of foetal acidosis due to impairment in uteroplacental circulation[13,14], maternal tachycardia and reactive hypertension and usage is limited by unpredictable absorption and tachyphylaxis[15,16]. Phenylephrine is associated with risk of reactive hypertension and bradycardia which will jeopardize the neonatal outcome by further potentiating foetal acidosis[17].

Moreover there is no clear vasopressor dosage regimen for preventing hypotension without affecting neonatal outcome. So risk of foetal acidosis and reactive hypertension complicates the use of pre-emptive and intraoperative usage[15,16,17].

Physical methods like left table tilt (12.5˚to15˚) and left uterine displacement using wedge relieves aortocaval compression and increases venous return. But studies have proven that these techniques do not prevent the hypotension significantly[18,19]. Venous pooling due to peripheral vasodilation is one of the most common reasons for hypotension in spinal anaesthesia hence methods like leg compression using elastic crepe bandage, esmarch bandage, compressive stockings and leg elevation were also studied for their effect on prevention of spinal hypotension. These methods are not only simple and easy but also have better foetal outcome and improvement in venous return without increasing cardiac workload[20,21] nevertheless localised ischemia and maternal discomfort may occur rarely.

We designed this study to compare the efficacy of these two simple and promising techniques of leg wrapping and leg elevation in preventing spinal anesthesia induced hypotension during elective caesarean section.

AIM AND OBJECTIVES OF STUDY

To evaluate and compare the effectiveness of two simple techniques: leg elevation and leg wrapping in prevention of spinal hypotension in elective caesarean section. To compare:

- Incidence of hypotension
- Vasopressor usage
- Haemodynamic changes

ANATOMY

VERTEBRAL CANAL[22,23,24]

Vertebral column is a midline structure extending from the base of the skull above to the pelvis below. It provides protection for the spinal cord and transfers weight through the pelvis, as well as having an extensive area for muscular attachment. It consists of bony vertebrae connected by intervertebral fibrocartilaginous discs. The adult spine has four curves : cervical and lumbar zones are convex anteriorly(lordosis) , thoracic and sacrum are concave anteriorly (kyphosis).

The spine consists of 33 vertebrae (7 cervical, 12 thoracic, 5 lumbar, 5 fused sacral, and 4 fused coccygeal). Typical cervical, thoracic, and lumbar vertebrae consist of a body anteriorly and neural arch posteriorly. Neural arch consists of two pedicles that project posteriorly from the body, and two laminae that connect the pedicles.

The lamina gives rise to the transverse processes that project laterally and the spinous process that project posteriorly. The pedicles contain a superior and inferior vertebral notch through which the spinal nerves exit the vertebral canal.

The superior and inferior articular processes arise at the junction of the lamina and pedicles and form joints with the adjoining vertebrae. The neural arch encloses a space called spinal canal or vertebral canal and contains the spinal cord with its meninges. The first cervical vertebra ("atlas") differs from this typical structure in that it does not have a body or a spinous process. Thoracic vertebra has articular facets on the vertebral bodies and transverse processes for articulation with the head and neck of the rib.

Lumbar vertebrae are the largest vertebrae and lacks foramina transversaria and costal facets. The bodies are large and kidney-shaped, the pedicles short and strong, and the transverse processes relatively small. . A line drawn between the iliac crests crosses the body of L4 (sitting position) or the L4-L5 interspace (lateral decubitus position). This line is called Topographic line of Tuffier.

Sacrum is formed by the fusion of the five sacral vertebrae. It forms the central axis of the pelvic girdle, and articulates above with the fifth lumbar vertebra, on the sides with the innominate bone (at the sacroiliac joints), and below with the coccyx. It is concave anteriorly and roughly wedge like in shape, and has four pairs of foramina for the exit of the spinal nerves. The sacral canal within the sacrum is created by the fusion of sacral vertebrae.

The fifth sacral lamina frequently fails to fuse and is called the sacral hiatus. The hiatus is bounded above by the fused fourth sacral lamina, laterally by the deficient lamina margins of S5 (bearing the sacral cornua) and below by the posterior surface of body of S5. Coccyx is formed from the fusion of four small and rudimentary coccygeal vertebrae. The surfaces provide attachment for nearby pelvic and gluteal muscles.

VERTEBRAL LIGAMENTS

Ligaments of vertebral column [22,23,24]

Intertervertebral discs – connect the vertebral bodies and make up 25% of the height of the spinal column. These consist of an outer annulus fibrosus and an inner annulus pulposus. The superior and inferior surfaces of the vertebral bodies are also lined with hyaline cartilage, which allow adhesion to the intervertebral discs.

Supraspinous ligament

It is a strong, tough, fibrous band, connecting the apex of the spines from the seventh cervical vertebra to the sacrum. At the lumbar region it is thick and broad. In the cervical region it blends with neck ligaments, Ligamentum nuchae – superior extension of the supraspinous ligaments and extends from C7 to the occiput.

Interspinous ligament

The interspinous ligament is a thin fibrous structure, connecting adjacent spines. The fibres are almost membranous and extend from the apex and upper surface of a lower spine towards the root and inferior surface of the next higher vertebra. These longitudinal fibres meet the supraspinous ligament posteriorly and tend to blend with the ligamentum flavum in front.

Ligamentum flavum

This consists of thick yellow elastic tissue. They extend between lamina from the anterior inferior surface of the upper lamina downwards to the anterior superior surface of the lower lamina. The right and left ligamentum flavum joins in midline forming acute angle in between them.

Anterior longitudinal ligament

It runs along the anterior surface of the vertebral bodies, from C2 to the sacrum. It adheres to the anterior surface of the vertebral bodies and the discs.

Posterior longitudinal ligament

It extends along the posterior aspect of the vertebral bodies and discs.

CONTENTS OF VERTEBRAL CANAL

Spinal cord

Cauda equina(below L1)

Meninges covering the spinal cord

Cerebrospinal fluid

Spinal blood vessels

Anatomy of the spinal cord [25]

At birth, the tip of the spinal cord lies at the level of the lower border of L3 and the dural sac at the third sacral vertebrae. After birth, the lengthening and growth of the cord, as well as the meninges, continue to lag behind the growth of the bony vertebral column. At one year of age, the conus medullaris is at the lower border of the second lumbar vertebra and the dural sac ends at the second sacral vertebra. Between 12-16 years of age, the adult relations are attained, and the spinal cord ends at the lower border of the 1st lumbar vertebrae. This placement is seen in 50% of patient and in about 40% it is located opposite the body of second lumbar vertebrae. The average length of the spinal cord in males is about 45cm, and in females it is about 42 centimetres. The average weight is approximately 30 grams.

The spinal cord gives rise to 31 pairs of spinal nerves, each composed of a ventral motor root and a dorsal sensory root. The nerve roots are in turn composed of multiple rootlets. The portion of the spinal cord that gives rise to all of the rootlets of a single spinal nerve is called a cord segment.

The skin area innervated by a given spinal nerve and its corresponding cord segment is called a dermatome. Because the spinal cord usually ends between L1 and L2, lumbar, and sacral nerve roots run increasingly longer distances in the subarachnoid space to take off from their spinal cord segment of origin to the intervertebral foramen through which they exit. Those nerves that extend beyond the end of the spinal cord to their exit site are collectively known as the caudaequina.

Meningeal coverings of the spinal cord [26,27]

Surrounding the spinal cord in the bony vertebral column are three membranes (from within to the periphery): the pia mater, arachnoid mater and dura mater.

Dura mater

This layer is the direct extension of the cranial dura mater and extends as spinal dura mater from the foramen magnum to S2, where the filum terminale blends with the periosteum on the coccyx.

Arachnoid mater

This is the middle of the three coverings of the brain and spinal cord. It is a delicate non-vascular membrane closely attached to the dura and ends at the lower border of S2. This is the principle barrier to the drugs crossing into and out of CSF. Almost 90% of resistance is offered by it.

.Pia mater

This is a delicate, highly vascular membrane, closely investing the spinal cord and brain. Denticulate ligaments are the folds of pia matter that extends laterally along the lines of attachments of the anterior and posterior roots. They act as struts to hold the spinal cord suspended within the subdural space.

Dural spaces

*Subarachnoid space***:**

Space between piamater and arachnoid mater and the contents are CSF, spinal nerves and blood vessels that supply the spinal cord and the lateral extensions of the pia mater and the dentate ligaments, which supply lateral support from the spinal cord to the dura mater. Although the spinal cord ends at the lower border of L1 in adults, the subarachnoid space continues to S2.

Subdural space:

The potential space between the dura mater and the arachnoid is the subdural space which contains only small amounts of serous fluid allowing the dura and arachnoid to move over each other.

Epidural space:

Surrounding the dura mater is the spinal epidural space that extends from the foramen magnum to the sacral hiatus. The epidural space is bounded anteriorly by the posterior longitudinal ligaments, laterally by the pedicles and the intervertebral foramina, and posteriorly by the ligamentum flavum. Contents of the epidural space include the nerve roots that traverse it from foramina to peripheral locations, as well as fat, areolar tissue, lymphatics, and blood vessels which include the well-organized Batson venous plexus.

Circulation of the Spinal Cord[25]

Arterial supply to the Spinal Cord

The principal arterial supply to the spinal cord is derived from one anterior and two pairs of posterior spinal arteries that descend from the level of the foramen magnum. The anterior spinal artery is formed at the foramen magnum by a branch from the terminal portion of each vertebral artery.

The anterior spinal artery descends the entire length of the spinal cord and with contributing arteries, supplies a major portion of the anterior two-thirds of the spinal cord.

The posterior spinal arteries are four longitudinal running vessels, two on each side. One lies in front of the attachment of the dorsal nerve root, and the other or larger artery lies behind the attachment. These arteries are derived at the base of the brain, either directly from the vertebral artery or more often from its primary branch of the posterior inferior cerebellar artery. They supply the posterior one third of the spinal cord, i.e., the posterior gray horns and white columns.

These arteries are reinforced by spinal branches of the vertebral, deep cervical, posterior intercostal, lumbar and lateral sacral arteries. Each spinal branch divides into an anterior radicular and posterior radicular artery that approaches the spinal cord along the ventral and dorsal roots. Frequently, one of these anterior radicular arteries is considerably larger than all the others and is termed the arteria radicularis magna, or the artery of Adamkiewicz. It arises from one of the intersegmental branches of the descending aorta at the lower thoracic or upper lumbar vertebral level usually on the left side (80%). This radicular artery may be responsible for the major blood supply of the lower two-thirds of the spinal cord in about 50% of the population.

Veins of the spinal cord

The venous drainage comprises a plexus of anterior and posterior spinal veins that drain along the nerve roots through the intervertebral foramen into the segmental veins; the vertebral veins in the neck, the azygos vein in the thorax, lumbar veins in the abdomen and lateral sacral veins in the pelvis. At the foramen magnum, they communicate with the medullary veins.

Cerebrospinal fluid (CSF)[24,27]:

The term CSF was first used in 1825 by French Physiologist F.Magandie. It is normally clear & colourless fluid that fills all the cavities and space around the CNS. It is isotonic with plasma. It is secreted mainly by choroid plexus of lateral ventricle & is reabsorbed by the arachnoid villi & granulations. In a normal adult CSF is formed at a rate of 25 ml/hr or 500 ml/day. The replacement of total spinal fluid under ordinary normal physiological circumstances is every 6 hours. CSF is a complex solution containing an array of molecules including electrolytes, proteins, glucose, neurotransmitters, neurotransmitter metabolites, cyclic nucleotides, amino acids, among many others.

CSF is produced by ultra filtration of plasma in the choroid plexus and the cerebral/spinal capillaries. The CSF volume is approximately 100 to 160 ml in adult humans of which 30 to 80ml is spinal CSF. Lumbo sacral CSF pressure is 15cmH20.

CSF is removed by arachnoid villi present in the superior sagittal sinus and along spinal nerve roots. Baricity is defined as the ratio of the density (mass/volume) of the local anesthetic solution divided by the density of CSF, which averages 1.0003±0.0003 g/mL at 37°C.

Solutions that have the same density as CSF have a baricity of 1.0000 and are termed isobaric. Solutions that are denser than CSF are termed hyperbaric, whereas solutions that are less dense than CSF are termed hypobaric. Baricity is important in determining local anesthetic spread and the block height. Hyperbaric solution tends to flow downward in CSF to the most dependent regions of the spinal column, whereas hypobaric solutions tend to rise in CSF. In contrast, gravity has no effect on the distribution of truly isobaric solutions.

Composition of CSF

Protein 15-45 mg/dL

Glucose 50-80 mg/dL

Non-protein nitrogen 20-30 mg/dL

Chloride 120-130 mEq/L

Sodium 140-150 mEq/L

Bicarbonate 25-30 mg/mL

pH 7.32 (7.27 – 7.37)

pCO2 48 mmHg

Cells < 5 cells / mm3

Circulation

From the lateral ventricles CSF passes through the foramina of Munro to the third ventricles, then through the aqueduct of sylvius to the fourth ventricle and then via foramen of Magendie to cisterna magna and via two foramen of Luschka into cisterna ponti. From the fourth ventricles it also passes into central canal of spinal cord. From the central subarachnoid space, it reaches spinal subarachnoid space through the foramen magnum. CSF is absorbed into cranial venous sinuses through arachnoid villi.

Functions of CSF

- It acts as cushion between the soft and delicate brain substance and rigid cranium.
- Drainage of metabolites
- Nutrition and oxygen supply to nerve cells

Technique of spinal anaesthesia[28]

Preparation

Asepsis

Position

Sitting

Lateral decubitus

Prone (jacknife)

Projection

Midline approach

Para median approach

Taylor's approach

Puncture

Structures pierced are skin, subcutaneous tissue, supraspinous ligament, Interspinous ligament, ligamentum flavum, duramater and arachnoid mater .When the spinal needle pierces the dura a sudden give way is felt, then the stylet of spinal needle is removed. Once CSF appears at the hub, local anaesthetic drug is injected at the rate of 0.2ml/second.

PHYSIOLOGY

Physiology of Central Neuraxial Blockade

Safe conduct of spinal anaesthesia needs better appreciation of physiological effects of spinal anaesthesia .Neuraxial anaesthesia blocks sympathetic and somatic nervous system (sensory and motor), evokes compensatory reflexes and unopposed parasympathetic activity.

The well recognized physiological effects of subarachnoid block are often mistakenly termed as complications. It is imperative to make a clear distinction between the physiologic effects of an anaesthetic technique and complications that implies some harm to the patients.

Factors affecting block height[29]

	More important	**Less important**
Drug factors	Dose Baricity	Volume Concentration viscosity
Patient factors	CSF volume Advanced age pregnancy	Height Spinal anatomy Intraabdominal pressure
Procedure factors	position	Level of injection Fluid current

Pharmacokinetics of spinal anaesthesia [30,31,32]

There is a fall in the concentration soon following the injection of anaesthetic agent into the subarachnoid space. The reason being,

1. Dilution and mixing of CSF
2. Diffusion and distribution to neural tissues
3. Uptake and fixation by neural tissues
4. Vascular absorption and elimination
5. Absorption through arachnoid villi

Initially, there is a rapid decrease in the concentration of drug, which occurs within 2-3 min soon after the injection of drug. This is due to mixing and dilution with CSF, which depends on the force or rate of injection of drug and amount or volume of fluid in the subarachnoid space.

The second phase of decrease in concentration is due to diffusion of agent in the spinal fluid by virtue of its molecular motion. At the same time some of the agent is being absorbed into the nervous tissue.

This absorption occurs along a concentration gradient to 3 sites:

1. The nerve roots directly bathed by the anaesthetics.
2. Directly into the spinal cord surface by diffusion through the piamater.
3. Into the deeper parts of the spinal cord parenchyma through Virchow-Robin spaces.

Uptake of local anaesthetic from the spinal fluid and from the nerve fibres into the vascular compartment accounts for the third phase of slow decrease in total concentration of agent in the spinal fluid. The greater portion of the drug leaves the subarachnoid space through the venous drainage, while a small portion leaves through small lymphatic channels. Little or no breakdown of local anaesthetic agents occurs in the subarachnoid space or in the CSF.

The sequence of nerve modality block [33,34]

1. Vasomotor block – dilatation of skin vessels and increase cutaneous blood flow.
2. Temperature fibres – cold first and then warmth
3. Loss of temperature discrimination
4. Pain – pin prick fibres first
5. Loss of tactile sensation
6. Motor paralysis
7. Pressure sensation
8. Proprioception and vibratory sensation

The recovery, return of sensibility is in the reverse order. Sympathetic blockade is the major determinant of physiologic response to spinal anaesthesia. Indirect effects of spinal anaesthesia may be considered as a result of paralysis of these nerves.

Effect of Spinal Anaesthesia on Various Organ system

Cardiovascular System [35]

Cardiovascular system encounters the most important physiologic response to spinal anaesthesia. They are mediated by combined autonomic denervation and higher levels of neural blockade and the added effects of vagal nerve intervention.

Sympathetic Denervation [36]

The level of sympathetic blockade determines the magnitude of cardiovascular responses to spinal anaesthesia. Higher the level of neuraxial blockade the greater would be change in cardio-circulatory parameters. In the presence of partial sympathetic blockade a reflex increase in sympathetic activity occurs in sympathetically intact areas. The result is vasoconstriction that tends to compensate for peripheral vasodilation taking place in sympathetically denervated areas.

Effects on:

Stroke volume

Heart rate

Coronary blood flow

STROKE VOLUME [35,36,37]

Sympathectomy following spinal anaesthesia usually decreases stroke volume. Venous and arterial vasodilation reduces preload (venous return) and afterload (systemic vascular resistance), respectively. Large amount of blood resides in the venous system (approximately 75% of the total blood volume), the venodilation effect predominates, owing to the limited amount of smooth muscle in venules; in contrast, the vascular smooth muscle on the arterial side of the circulation retains a considerable degree of autonomous tone. So cardiac output is maintained or slightly decreased during spinal anaesthesia.

The vasodilatory changes after neuraxial blockade that can affect cardiac output depend on each patient's baseline sympathetic tone (patients with higher sympathetic tone exert greater haemodynamic response) and the extent of the sympathectomy (i.e., the height of the block). Total peripheral vascular resistance decreases only about 15% to 18% in normal subjects in the presence of total sympathetic denervation provided the cardiac output and other determinants of blood pressure are kept normal.

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Heart Rate [38,39,40,41]

Heart rate may decrease during a high neuraxial block as a result of blockade of the cardioaccelerator fibers arising from T1-T4.

Heart rate may also decrease in the presence of extensive peripheral sympathectomy (T5-L2), with venous pooling in the lower extremity and the abdominal and pelvic viscera. Hypotension will trigger a compensatory baroreceptor sympathetic response that causes vasoconstriction and increased heart rate (Marey's law), where as the reduction in venous return and right atrial filling causes a decrease in signal output from intrinsic chronotropic stretch receptors located in the right atrium and great veins, leading to a marked increase in parasympathetic activity (Bainbridge reflex)[42]. These two opposing responses are usually in check with a minimal change in heart rate. Perhaps when neuraxial anesthesia is extended to the T1 level, blockade of the cardio accelerator fibers in addition to a marked reduction in venous return may result in severe bradycardia and even asystole because of unopposed parasympathetic activity.

. The Bezold Jarisch reflex arises from mechanoreceptors and chemoreceptors found primarily in the inferoposterior wall of the left ventricle which are activated by ventricular distension and stretching. Activation of this reflex results in increased parasympathetic activity and inhibition of sympathetic activity. Thus Bezold Jarisch reflex causes bradycardia and circulatory collapse especially in the presence of hypovolumia owing to small end systolic volume.

CORONARY BLOOD FLOW[38,43]

During spinal anaesthesia coronary blood flow decreases (from 153 to 74 ml/100 g per minute)which paralleled the decrease in mean arterial blood pressure (from119 to 62 mm Hg) , but the percent extraction of myocardial oxygen remains unchanged (75% to 72%). This is because myocardial work as expressed by myocardial use of oxygen (16 to 7.5 ml/100 g per minute), also parallels the decrease in mean arterial blood pressure and coronary blood flow.

PHYSIOLOGY OF HYPOTENSION IN SPINAL ANAESTHESIA[38,44]

Hypotension is the most common immediate complication of spinal Anaesthesia. Hypotension following spinal anaesthesia is primarily the result of paralysis of preganglionic sympathetic fibres that transmits motor impulses to smooth muscles of the peripheral vasculature. Degree of hypotension was proportional to the number of sympathetic fibres blocked. Sympathetic block causes hypotension by:

- Generalized arterial and arteriolar dilatation –decrease in systemic peripheral vascular resistance (decrease in afterload)
- Venous dilation which causes peripheral venous pooling leading to decrease in venous return (decrease in preload)

T1-T4 constitutes the cardiac accelerator fibres. If the blockade extends above the level of T5, it becomes progressively more difficult to compensate for the hemodynamic change and the blood pressure will be markedly reduced. Hypotension during spinal anaesthesia usually develops during the first 15-20 minutes. For this reason, the first half hour of spinal anaesthesia is considered to be its dangerous period. After the blood pressure has reached its lowest point, the systolic blood pressure often increases spontaneously 5-10 mm hg over the next 10-15 minutes after which its levels offend remains relatively fixed until the effect of anaesthetic nerve roots has worn off. This small increase is a manifestation of compensatory circulatory activity mediated reflex and perhaps by a slight return of smooth muscle tone in the denervated portion of the peripheral vasculature.

CEREBRAL BLOOD FLOW[45,46,47]

Cerebral blood flow is governed by two main factors. Mean arterial blood pressure and local resistance to blood flow in cerebral vessels. Spinal Anaesthesia theoretically could influence cerebral blood flow altering either blood pressure or cerebrovascular resistance or both.

Cerebrovascular auto regulatory mechanism maintains cerebral blood flow in humans at constant levels in the presence of wide fluctuations in

mean arterial blood pressure. Cerebral blood flow will become pressure dependent only if the mean arterial pressure falls below 55 mm Hg. Cerebrovascular auto regulation is independent of the sympathetic nervous system. Cerebral blood flow remains unaffected in normal persons even when mean arterial pressure decreases from 90 to 60 mm Hg during spinal Anaesthesia.

RESPIRATORY SYSTEM [38,48,49,50]

Neuraxial block induced alterations in pulmonary variables imposes little clinical consequences. Due to paralysis of abdominal muscles and intercostal muscles in spinal anaesthesia:

Vital capacity decreases

Expiratory reserve volume decreases

Functional reserve volume decreases

These effects are compensated by unaltered diaphragmatic function and function of accessory muscles like sternomastoid and scalenes muscle which are used for forced inspiration and expiration.

Respiratory arrest associated due to spinal anesthesia is often unrelated to phrenic or inspiratory dysfunction, but rather due to hypoperfusion of the respiratory centres in the brainstem.

Apnoea may be due to medullary ischemia. Lowered arterial and venous tone also lessens the work of the heart and tends to relive any existing pulmonary congestion. The pulmonary gas-exchange is preserved.

GASTROINTESTINAL SYSTEM [38,50,51]

Pre-ganglionic sympathetic fibres from T5-Ll are inhibitory to the gut. Sympathetic denervation in spinal anaesthesia results in contracted gut and hyper peristalsis.. Pressure within the bowel lumen is increased. Nausea and vomiting due to the hypotension and hyper peristalsis may occur and usually comes on in waves lasting a minute or so and passes away spontaneously.

ENDOCRINE SYSTEM[38, 50]

Spinal block delays adrenal responses to injury and trauma, so there is no change in the levels of 17- hydroxy corticosteroids. Spinal block suppresses the hyperglycaemic response to surgery and stress and so is useful in diabetic patients. The response to insulin is augmented, one should be aware of possibility of hypoglycaemia. Infused glucose through IV is well utilized.

GENITOURINARY SYSTEM[38, 50,52,53]

Sympathetic supply to kidney is from T11-L1 via the lower splanchnic nerve. Any effects on renal function are solely dueto hypotension, renal blood flow is decreased but does not cease until blood pressure has fallen to about 80mm Hg. These changes are transient and disappear when blood pressure rises again. The penis is often engorged and flaccid due to paralysis of Nervi erigenti (S2-S3) and this is also a positive sign of a successful block. Post spinal retention of urine may be moderately prolonged as S2-S3 contains small autonomic fibres and their paralysis lasts longer that of larger sensory and motor fibres. During prolonged blockade of lumbar and sacral segments, the bladder must be palpated so that catheterization can be employed whenever necessary.

UTERUS[38, 50]

The tone of uterus is not greatly altered after spinal analgesia in pregnancy. Block of nerves from T11 downwards results in painless labour. In late pregnancy, smaller doses of local anaesthetics are required because of decreased extradural space.

BODY TEMPERATURE [38,50]

Thermo regulation is impaired in spinal anaesthesia because of decrease in core temperature resulting from redistribution of heat from core to periphery due to vasodilation. This promotes heat generating mechanism in the body especially shivering in the unblocked region is the most common response .This response may transiently increase oxygen demand.

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PHARMACOLOGY

PHARMACOLOGY OF LOCAL ANAESTHETIC

Local anaesthetics are drugs that reversibly block nerve conduction, when injected locally to nerve tissue in appropriate concentrations.

General Properties of Local Anaesthetics [54,55]

The structure of anesthetic drug consists of a lipophilic aromatic ring and a hydrophilic tertiary amine. The intermediate link is either by an ester or an amide.

Local anaesthetics have to cross the axonal membrane to reach the binding site. A swift change in the valency of amino nitrogen moiety takes place for penetration. High concentration of unionised form is required for penetration and ionised form is required for action on target organ.

$$R{=}N + H{+} \quad \rightarrow \quad R = NH{+}$$

Local anesthetic exist in an aqueous solution in a chemical equilibrium between ionised and unionised form . This depends on pH of solution and pKa of drug. When pH= pKa, ionised=unionised form.

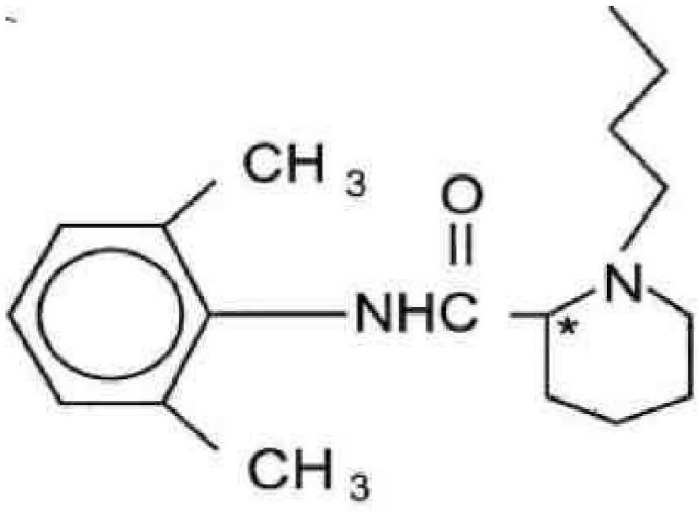
At physiological pH (7.4), concentration of ionised form is more than that of the unionised form. Increase in the pH causes increase in unionised form and hence increases penetration.

PHARMACOLOGY OF BUPIVACAINE[56]

Bupivacaine, an amino amide local anaesthetic was first synthesized in Sweden by A.F. Ekenstam and his colleagues in 1957.

First report of its use was in 1963 by L.J. Teluvio. It is one of the long acting local anaesthetic agents available, which is extensively used for intrathecal, extradural and peripheral nerve blocks. It is a white crystalline powder soluble in water.

CHEMICAL STRUCTURE OF BUPIVACAINE



Bupivacaine has an IUPAC nomenclature of 1-butyl-n-(2,6-dimethylphenyl) piperidine-2-carboxamide.

Physiochemical properties [47]

Molecular formula : $C_{18}H_{28}N_{2O}HCl$

Molecular weight : 288.43 g/mol

Solubility in water : 25mg/ml

pH of saturated solution : 5.2

pKa : 8.1

Specific gravity : 1.021 at c37 °C

Melting point : 247 - 258°C

Mechanism of action[54, 55]

Mechanism of action of bupivacaine is similar to that of any other local anaesthetic. The primary action of local anaesthetics is on the cell membrane axon, on which it produces electrical stabilization. Bupivacaine prevents transmission of nerve impulses (conduction blockade) by inhibiting passage of sodium ions through ion-selective sodium channels in nerve membranes. The sodium channel is a specific receptor for local anaesthetic molecules. Failure of sodium ion channel permeability to increase slows the rate of depolarization such that threshold potential is not reached and thus an action potential is not propagated. Local anaesthetics do not alter the resting transmembrane potential or threshold potential.

Bupivacaine is available in the following concentrations [57]

0.25%, 0.5%, 0.75%

0.25% and 0.5% solution in isotonic saline

0.5% solution in 8% dextrose

Dosage for caesarean section is 7.5 to 15 mg of 0.5% bupivacaine.

ONSET OF ACTION[57]

The onset of conduction blockade is dependent on the dose or concentration of the local anesthetic. The onset of action of bupivacaine is between 4 – 6 mins and maximum anaesthesia is obtained between 15 – 20 minutes.

DURATION OF BLOCK [57]

Two segment regression time for bupivacaine is90-140 minutes.

PHARMACOKINETICS[54,55,57]

The concentration of bupivacaine in blood is determined by the amount injected, the rate of absorption from the site of injection, the rate of tissue distribution and the rate of biotransformation and excretion of bupivacaine.

Plasma levels are related to the total dose administered, peak levels of 0.14 to 1.18µg/ml were found within 5 mins to 2 hrs, and they gradually declined to 0.1 to 0.34µg/ml by 4 hrs.

PLASMA BINDING

In plasma, drug binds avidly with protein to the extent of 70 -90%.

ABSORPTION

The site of injection, dose and addition of a vasoconstrictor determine the systemic absorption of bupivacaine. Absorption is faster in areas of high Vascularity.

TOXICITY

The toxic plasma concentration is set at 4 to 5 µg/ml. maximum plasma concentration rarely approach toxic levels.

PHARMACODYNAMICS[57]

CENTRAL NERVOUS SYSTEM

In higher dosage bupivacaine readily crosses the blood brain barrier and causes CNS depression. The initial symptoms involve feeling of light-headedness and dizziness followed by visual and auditory disturbances. Disorientation and drowsiness may occur.

Objective signs are usually excitatory in nature, which includes shivering, muscular twitches and tremors, initially involving muscles of the face (perioral numbness) and part of extremities.

CARDIOVASCULAR SYSTEM

The primary cardiac electrophysiological effect of a local anesthetic is a decrease in the maximum rate of depolarization in Purkinje fibers and ventricular muscle which is greater for bupivacaine. The rate of recovery of block is slower with bupivacaine. Therefore bupivacaine is highly arrythmogenic. Bupivacaine reduces the cardiac contractility by blocking the calcium transport.

RESPIRATORY SYSTEM

Respiratory depression may be caused if excessive plasma level is reached which in turn results in depression of medullary receptor center.

ADVERSE EFFECTS

Adverse effects are encountered in clinical practice mostly due to overdose, inadvertent intravascular injection or slow metabolic degradation.

CENTRAL NERVOUS SYSTEM

Nervousness, dizziness, blurring of vision or tremors, followed by drowsiness, convulsions, unconsciousness and respiratory arrest.

CARDIOVASCULAR SYSTEM

Myocardial depression, hypotension, arrhythmia, ventricular type conduction defect, SA node depression and cardiac arrest.

ALLERGIC REACTIONS

Urticaria

Bronchospasm

Hypotension

Other - nausea, vomiting, chills, constriction of pupil and tinnitus

CARDIOVASCULAR / CNS RATIO [57]

The CC / CNS dose ratio for bupivacaine is 3.7 ± 0.5 indicating that 3 times drug is required to induce irreversible cardiovascular collapse as was needed to produce convulsions. It has also been suggested that some of the enhanced cardiac toxicity is due to enhanced myocardial uptake.

Treatment

One should be prepared to maintain circulation and to support ventilation with oxygen and controlled ventilation.

- Supportive treatment with IV Fluids and vasopressors.
- Infusion of lipid emulsion
- Convulsions may be controlled with diazepam or muscle relaxants.
- Corticosteroids if allergic reactions suspected.

REVIEW OF LITERATURE

Kunal Singh et al[58] conducted a double blinded randomised control study in 2014 to evaluate haemodynamic changes after leg wrapping in elective caesarean section under spinal anaesthesia. In their study a total of 60 full-term parturients with an uncomplicated pregnancy belonging to American Society of Anesthesiologist I or II were allocated randomly (30 in each group) to have their legs wrapped with elastic crepe bandage or no wrapping was done. All patients received intravenous (IV) crystalloid (20 ml/kg) 15 min prior to spinal injection and were placed in left lateral position. Electrocardiography and oxygen saturation was monitored continuously and heart rate, blood pressure was measured every 2 min until delivery of baby and every 5 min thereafter until end of caesarean section. Any episode of significant hypotension was treated with IV phenylephrine 50µg bolus doses. They found that the frequency of hypotension was significantly less (P = 0.009) in Group B (legs wrapped group) 3 (10%) patients when compared with Group A (control group) 13 (43.33%). In Group A 10 (33.33%) patients and in Group B 3 (10%) patients required rescue dose with phenylephrine which was statistically significant (P = 0.0003).

Difference in the "mean change of arterial pressure" between Group A and B was highly significant ($P < 0.001$) recorded at 4, 6, and 8 min.They concluded that Incidence of hypotension can be reduced by wrapping the legs with elastic crepe bandage with a subsequent reduction in the use of potent vasopressor.

Nahed F., Khedr et al[59] conducted a study in 2011 to explore the effect of wrapping and/or raising of the legs as a preventive measures to reduce post - spinal anesthesia hypotension for elective caesarean delivery. The study was conducted in the operating room (caesarean section) at ain shams maternity hospital. In their study 120 parturients who were undergoing elective caesarean section were randomly scheduled to four groups: group (i) (n=30) parturients legs wrapped immediately before anaesthesia and elevated immediately after anesthesia administration. Group (II) (n=30) parturients legs wrapped , tightly wrapping was achieved after leg elevated to 45 degree for 2 minutes, with an elastic bandage applied from ankle to mid – thigh, immediately before anesthesia administration.

Group (III) (n=30) parturients legs elevated to 20 degree immediately after anesthesia administration. Group (IV) (n=30) no intervention.

Their tools of data collection consisted of 1) Demographic data,2)Automated monitors for measurement of blood pressure,3)Graphic flow sheet to record blood pressure, and 4) neonate assessment sheet to record Apgar score at 1and 5minutes. They concluded that there is no inter group differences regarding their age, body mass index & baseline and mean systolic arterial pressure MSAP. A significant difference was noticed among the groups. Group I (wrapping & elevation) had a higher MSAP, lower percent of hypotension, late onset time of hypotension and a lower percent of babies with bad neonatal outcome. They concluded that wrapping and elevation of the legs for parturients at spinal block for caesarean section was more effective measure to prevent hypotension. They concluded recommending wrapping and elevation of the legs should be used in addition to traditional measures to prevent post-spinal hypotension as a non-pharmacological technique.

Adsumelli et al[60] in 2003 studied the use of a Sequential Compression Device (SCD) with thigh-high sleeves and a preset pressure of 50 mm Hg that recruits blood from the lower limbs intermittently, as a method to prevent spinal hypotension during elective Caesarean section. They studied the Possible association of arterial pressure changes with maternal, fetal, haemodynamic, and anaesthetic factors.

. In their study fifty healthy parturients undergoing elective Caesarean section under spinal anaesthesia were randomly assigned to either SCD (n=25) or control (n=25) groups. A standardized protocol for pre-hydration and anaesthetic technique was followed. Hypotension was defined as a decrease in mean arterial pressure measurement by more than 20% of the baseline MAP. Systolic arterial pressure, mean arterial pressure and diastolic arterial pressure, pulse pressure and heart rate were noted at baseline and every minute after the spinal block until delivery. A hypotension occurred in 52% of patients in the SCD group versus 92% in the control group (P=0.004, odds ratio 0.094, 95% CI 0.018±0.488).. SCD use in conjunction with vasopressor significantly reduced the incidence of a hypotension.

L.J.Van Bogaert et al[61] conducted a double blind study in 1998 to investigate whether wrapping or elevation of legs prevents post spinal hypotension in caesarean section. In their study 82 parturients in a community hospital were randomly allocated to one of four groups: Group 1- leg raising; Group 2 – leg wrapping ; Group 3: leg wrapping and raising; Group 4 -no intervention . The outcome measures of upper level of blockade, pulse rate, systolic arterial pressure were noted and studied. In their study they concluded that the SAP remained significantly higher with wrapping but not with elevation.

The number of episodes of hypotension was significantly reduced by wrapping (15.8%) as compared to controls (45.5%) (P = 0.012). Elevation did not prevent hypotension (P = 0.38) They concluded that wrapping of legs prevent post spinal hypotension .

Ghabash M et al[62] conducted a randomised control study in 1997 to analyse the effect of preanaesthetic wrapping of legs for prevention of spinal hypotension. In their study Forty-four male patients undergoing herniorrhaphy under spinal anesthesia were allocated to 2 groups. Group I had 15 ml/kg of lactated ringer intravenously as prehydartion for prevention of spinal induced hypotension. Group 2 had the trendelenbourg position to 30 degrees for 2 minutes and the legs wrapped with elastic esmarch bandage prior to spinal anesthesia without fluid prehydration. In both groups, ephedrine was used to treat spinal induced hypotension defined by decrease in the systolic arterial pressure less than 75% of the baseline value. The incidence of hypotension was greater in the fluid prehydration group (4 of 22) as well as the mean dose of ephedrine required to treat hypotension (7 +/- 10 mg) than the group with wrapping of the legs (1 of 22 and 5 +/- 0 mg). They concluded that trendelenberg position and wrapping of the legs prior to the spinal block might prevent the sudden decrease in arterial blood pressure that occurs during spinal anesthesia.

C.C.Rout et al[63] had conducted a study in 1993 which ninety-seven parturients undergoing elective Caesarean section were allocated randomly to have their legs elevated to approximately 30" on pillows or elevated and wrapped with elastic esmarch bandages or neither (control) following spinal anaesthesia. All patients received intravenous crystalloid (20 ml/kg over 20 min) prior to spinal injection and were placed in the left lateral tilt position. Significant hypotension was treated with intravenous ephedrine in 5 mg bolus doses. They concluded that leg wrapping resulted in a significant reduction in the incidence of postspinal hypotension in comparison to the control group (18% compared to 53%, p = 0.004)**.** This represents five-fold reduction in the likelihood of postspinal hypotension (odds ratio 5.3, 95% CI 1.7-16.3). Leg elevation alone did not significantly reduce the incidence of' hypotension (39%). No significant difference in the time of onset of hypotension between the groups were noted.. For those patients requiring ephedrine, there was no significant difference in mean dose requirements between the groups. The use of leg compression immediately postspinal provides simple means of reducing the accompanying hypotension and should be used more wide.

Bhagwanjee S et al[64] conducted a study in 1990 in which Twenty-four parturients undergoing elective Caesarean section were allocated randomly to have the legs wrapped with elastic esmarch bandages immediately following spinal anaesthesia or to serve as controls. Significant hypotension (systolic arterial pressure less than 100 mm Hg and less than 80% of baseline value) was treated with intravenous ephedrine in 5mg boluses. Leg wrapped patients had a significantly (P = 0.0033) lower incidence (16.7%) of hypotension than controls (83.3%). Only two patients in the leg wrapped group required ephedrine compared with 10 in the control group. Systolic arterial pressure was significantly (P less than 0.05) less in control subjects at 4, 5 and 6 min following spinal injection. No patient in the leg wrapped group became hypotensive following removal of the elastic bandages.

MATERIALS AND METHODS

This prospective, double-blinded, and randomized controlled trial was undertaken after the approval by Institutional Ethical Committee. A written informed consent was obtained from each patient for participation in the study. 90 full term pregnant patients with singleton uncomplicated pregnancy belonging to American Society of Anesthesiologists Class I or II, scheduled for elective caesarean section under spinal anesthesia were allocated randomly by lots to either Group BLW (leg wrapping) (n = 30) or Group BLE (leg elevation) (n = 30) or Group BC(control).

INCLUSION CRITERIA **:** ASA grade 1 or 2

Single live foetus

Gestational age 37 weeks or above

Uncomplicated pregnancy

EXCLUSION CRITERIA **:** Patient refusal

Allergy to the drug-bupivacaine

Patients on cardiovascular medications

Foetal anomaly

Pregnancy induced hypertension

Multiple gestation

Contraindication for spinal anaesthesia

90 Parturients posted for elective caesarean section were randomly selected for the study. All Patients were thoroughly examined and investigated preoperatively and were explained about the anaesthetic technique. Written informed consent was obtained from the patient.

Patient characteristics including age, height, weight, and gestational age was recorded. All the patients were kept overnight fasting before surgery. For all patients, intravenous line was secured using an 18Gauge cannula. All the patients were given injection Ranitidine 50mg intravenously and injection metacloproamide 10mg intravenously 30 minutes before surgery.

Patient was shifted to operation table and standard monitors like pulse oximeter, non-invasive blood pressure cuff, electrocardiogram leads were connected. Baseline blood pressure and heart rate were measured in supine wedged position. Intravenous fluid preloading was then done with 20 ml/kg of ringer lactate solution over 15 to 20 minutes just prior to the spinal anesthesia.

Group BLW patients (n = 30) had their lower limbs wrapped just before the administration of the subarachnoid block. Leg wrapping was achieved with crepe bandage (15 cm width, 4 m stretched length) applied from the ankle to the mid-thigh in both legs in turns; during wrapping lower extremities were lifted at an angle of 45°;after wrapping legs were

placed in neutral position and covered. The crepe bandages were wrapped tightly enough that the women felt the tightness, yet it was comfortable and not painful. Care was taken to avoid compressing the legs to greater than arterial pressure by checking for capillary pulsation in the toes. All patients had their leg wrapped by the same person in around 3 min to eliminate bias introduced by method or altered force of wrapping.

Group BLE (n=30) patients had their legs elevated immediately after spinal anaesthesia such that they were at an angle of 30˚ to the horizontal plane and covered.

Group BC (n=30) patients had their lower limbs neither raised nor wrapped, but they were simply covered.

ANAESTHESIA TECHNIQUE:

Under all aseptic precautions, spinal anesthesia was performed in all patients in the sitting position using a 25Gauge Quincke's spinal needle in the L3-L4 interspace through midline approach. All patients were given injection 0.5% hyperbaric bupivacaine in the dose of 0.06mg/cm of height[65]. Thereafter, the patients were placed supine wedged position. All patients were given oxygen at 6L/min through Hudson's face mask. The time of injection of spinal drug is noted as "0" minute.

Maximum sensory block achieved and time to maximum sensory block were also noted for all patients. Fluid replacement was maintained with ringer's lactate solution. Electrocardiography and oxygen saturation was monitored continuously and the heart rate and blood pressure was measured every 2 minutes up to 20 minutes and every 5 min thereafter up to 60minutes. Time from spinal to delivery and delivery to end of surgery were noted. Total duration of surgery and any intraoperative complications such as nausea, vomiting, hypotension, bradycardia, and dyspnoea were recorded.

Hypotension was defined as fall in systolic blood pressure to 90 mmHg or fall more than 20% from baseline blood pressure. Hypotension was treated immediately by increasing the rate of ringer lactate administration and by ephedrine 6mg intravenously. Total dose of ephedrine used were noted. Parameters were monitored and recorded in a specially prepared proforma by other post graduate who was not aware of the technique applied.

Leg wrapping was removed at the end of surgery. Patients of leg elevation group were resumed to supine position at the end of surgery. Patients of all three groups were monitored for 10 minutes after surgery.

STASTICAL ANALYSIS

The information collected was recorded in a master chart. Data entry was done using SPSS 22 for Windows. The data collected were subjected to statistical analysis using statistical package for social sciences. Analysis of variance with post hoc test for demographic and clinical data and 2x2 chi square test for incidence of hypotension were used to test the significance . A ‘p’ value of less than 0.05 was taken to denote the statistical significance.

OBSERVATION AND RESULT

All 90 patients in the study groups participated in the study and there was no exclusion during the study. Data was presented as mean with standard deviation. The 'P' value of less than 0.05 was considered as statistically significant. None of the patients were excluded from the study.

TABLE 1: COMPARISON OF DEMOGRAPHIC DATA:

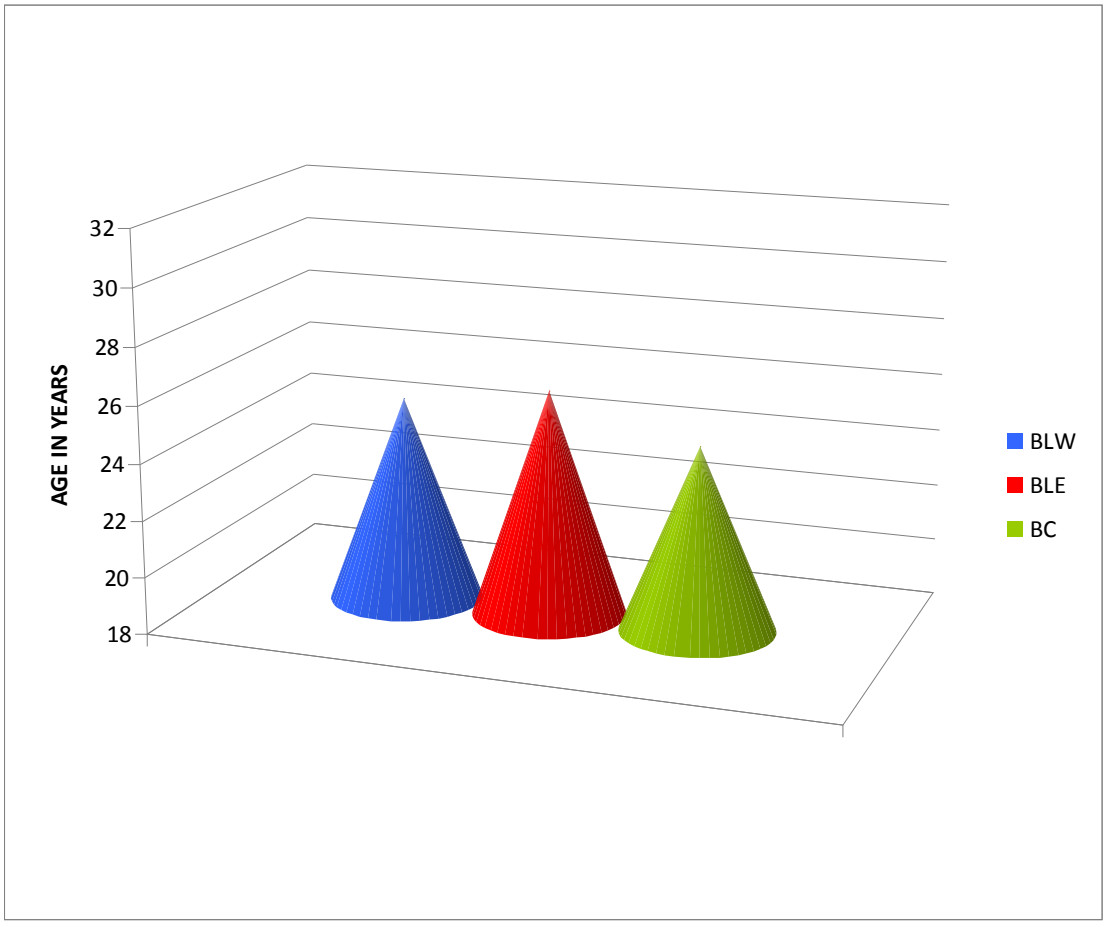
VARIABLES	MEAN± STANDARD DEVIATION			'F' VALUE	'P' VALUE	SI
	BLW	BLE	BC			
Age (years)	25.2±3.7	25.9±3.8	24.3±3.9	1.295	0.279	NS
Weight (kg)	57.7±4.3	58.1±4.1	58.1±3.8	0.081	0.923	NS
Height (cm)	149.9±5.4	150.8±4.5	151.2±4.4	0.514	0.600	NS
Gestational Age (weeks)	37.6±0.7	37.8±0.6	37.6±0.6	0.942	0.394	NS

SI – Statistical inference NS – Non significant

COMPARISON OF AGE

Parturients with uncomplicated singleton pregnancy of term gestational age are included in the study. Patients' age varied between 19-31 years. The mean age of group BLW was 25.2years, group BLE was 25.9 years and that of group BC was 24.3. There is no statistical difference in age comparison among the groups .[Table:1; Figure 5]

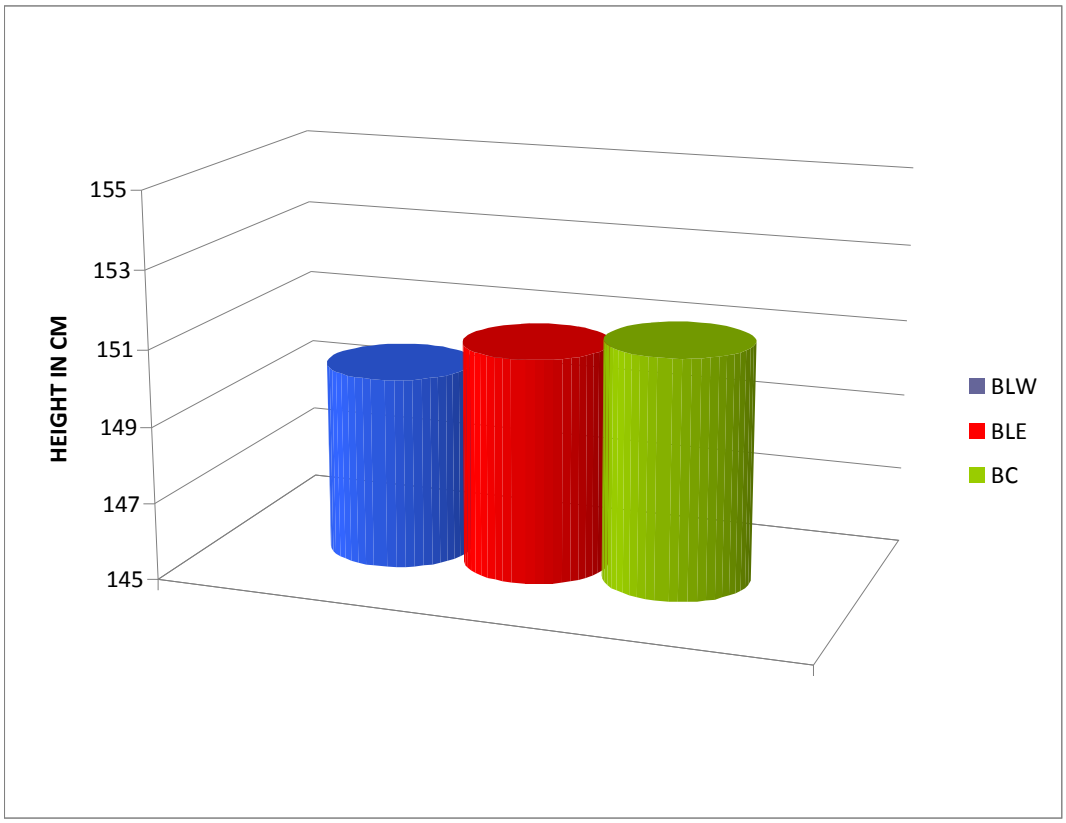
FIGURE 5: COMPARISON OF AGE



Comparison of height:

All the patients are comparable with regards to height. The mean height in group BLW was 149.9 cm, group BLE was 150.8cm and that of group BC is 151.2cm. As shown in table 1 there is no statistical difference among the groups[Figure:6].

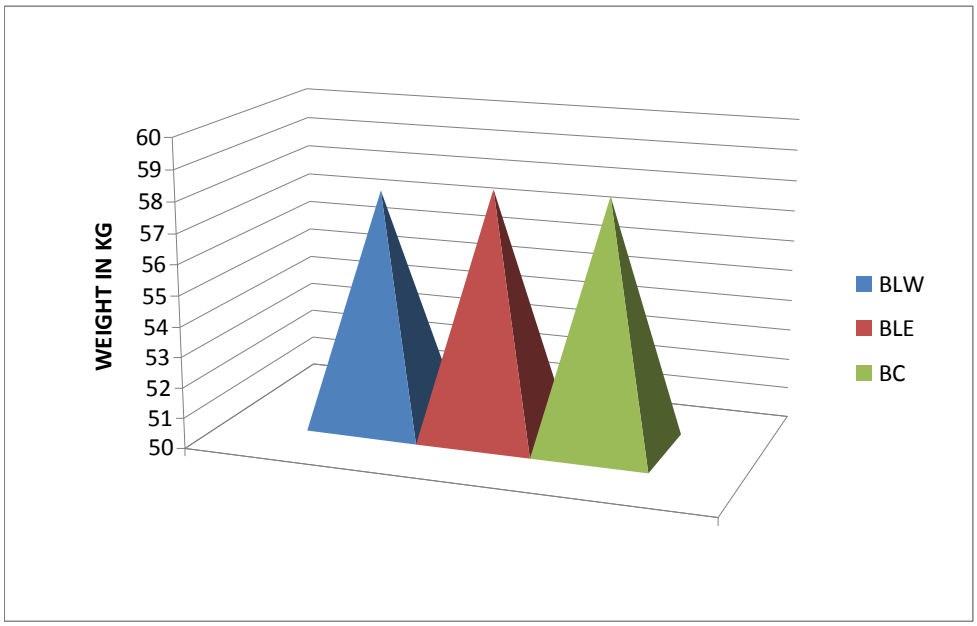
FIGURE 6: COMPARISON OF HEIGHT



Comparison of weight :

All patients are comparable with regard to weight . The mean weight of the parturients of group BLW was 57.7kg, group BLE was 58.1kg and group BC was 58.1kg . There is no statistical difference observed among the groups. [Table:1;Figure7]

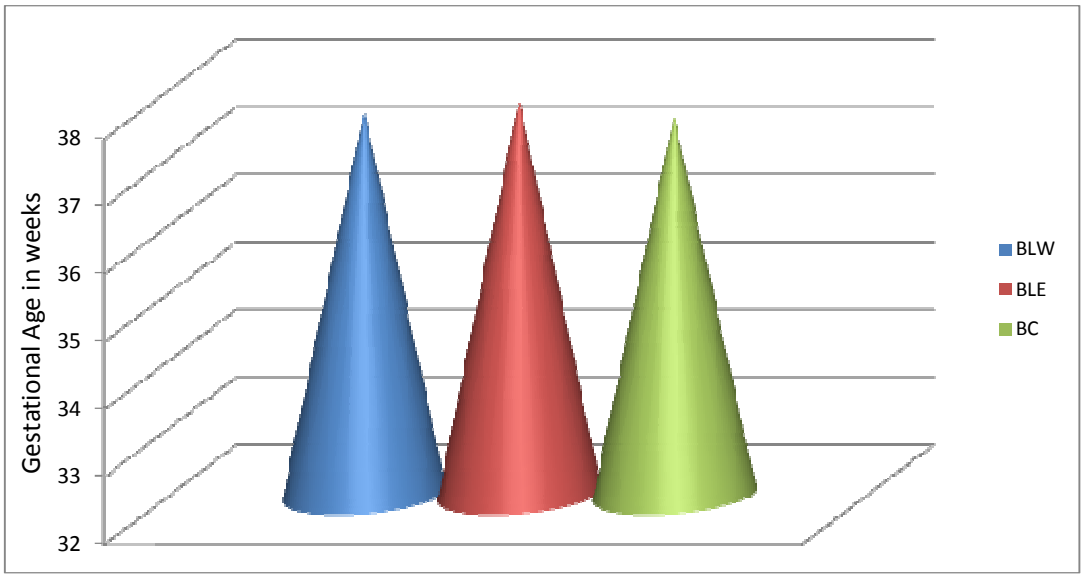
FIGURE:7 COMPARISON OF WEIGHT



Gestational age :

All patients are term parturients allotted randomly to groups . The mean gestational age of group BLW was 37.6 weeks, group BLE was 37.8 weeks and group BC was 37.6 weeks. The gestational age of groups is comparable and there is no significant statistical difference among the groups.[Table 1;Figure 8]

FIGURE: 8 COMPARISON OF GESTATIONAL AGE



COMPARISON OF CLINICAL DATA :

In all the patients time from spinal to delivery of baby, time from delivery to end of surgery ,total duration of surgery ,maximum cephalad sensory block height and time to reach maximum sensory block were also noted . Results are shown in table 2.

TABLE : 2 COMPARISON OF CLINICAL DATA:

VARIABLES	MEAN±STANDARD DEVIATION			'F' VALUE	'P' VALUE	SI
	BLW	BLE	BC			
TIME FROM SPINAL TO DELIVERY OF BABY(MINS)	7.17±0.83	7.20±0.66	7.27±0.52	0.166	0.848	NS
TIME FROM DELIVERY TO END OF SURGERY (MINS)	40.50±2.78	41.90±3.78	40.63±2.83	1.785	0.174	NS
TOTAL DURATION OF SURGERY (MINS)	47.67±2.65	49.10±3.71	47.90±2.90	1.816	0.169	NS
MAXIMUM CEPHALOD SENSORY BLOCK LEVEL	T5(T4-T6)	T5(T4-T6)	T5(T4-T6)	-	-	NS
TIME TO MAXIMUM SENSORY BLOCK LEVEL(MINS)	3.13±0.81	3.17±0.74	3.27±0.52	0.289	0.750	NS

SI – Statistical inference NS – Non significant

***TIME FROM SPINAL TO DELIVERY OF BABY*:**

The mean duration from spinal to delivery of baby in group BLW was 7.17 minutes, group BLE is 7.20 minutes and in group BC was 7.27 minutes. There was no statistical difference among the groups. [Table 2;Figure 9]

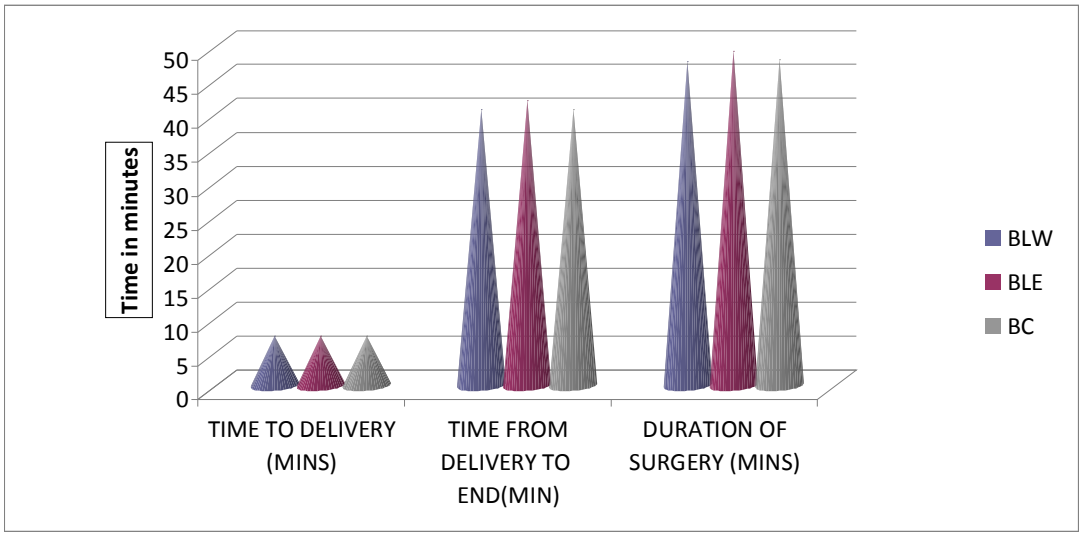
DURATION FROM DELIVERY TO END OF SURGERY:

Similarly with regards to time from delivery to end of surgery all patients are comparable. The mean time from delivery to end of surgery in group BLW was 40.50minutes, group BLE was 41.9minutes and group BC was 40.63minutes.There was no statistical difference among the groups. [Table 2; Figure 9]

***DURATION OF SURGERY*:**

The mean duration of surgery ingroup BLW was 47.67minutes, group BLE was 49.10 minutes and that of 47.90 minutes .duration of surgery was comparable in all patients. No statistical difference was observed among the groups. [Table 2;Figure 9]

FIGURE 9: COMPARISON OF DURATION



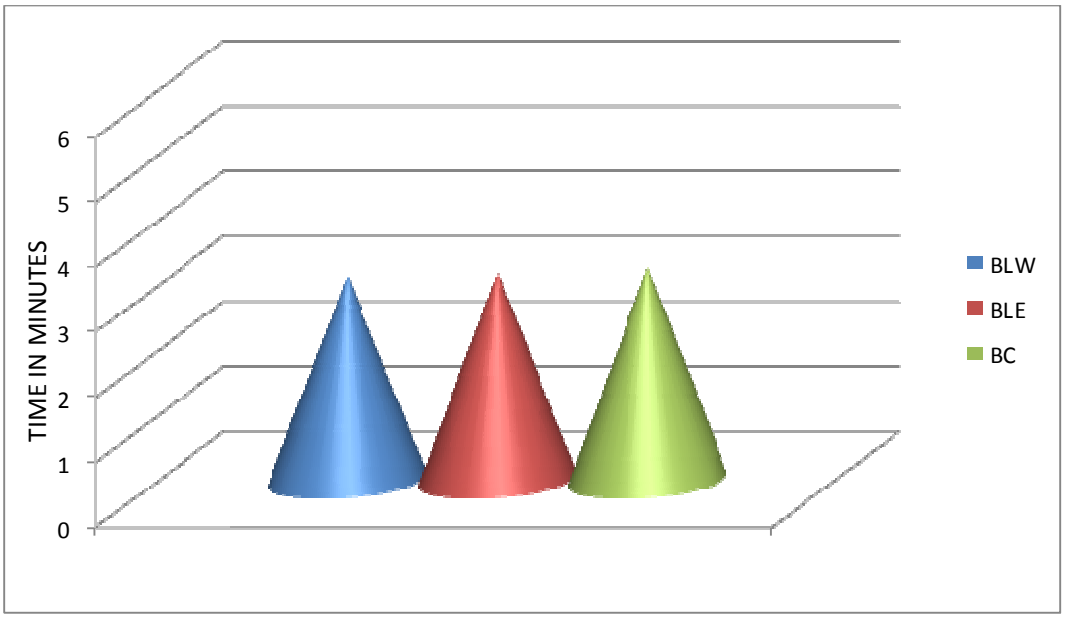
MAXIMUM SENSORY BLOCK HEIGHT:

The maximum cephalad sensory block height was in the range between T4 and T6 in all the patients. Almost the sensory block height was around T5 in all three groups .No statistical difference was observed [Table 2].

***TIME TO REACH MAXIMUM SENSORY BLOCK HEIGHT*:**

The mean of time to reach maximum sensory block height in group BLW was 3.13 minutes ,group BLE was 3.17minutes and group BC was 3.27 minutes .No statistical difference was observed among the groups [Table 2; Figure 10]

FIGURE 10: COMPARISON OF TIME TO MAXIMUM SENSORY BLOCK LEVEL



COMPARISON OF HAEMODYNAMIC VARIABLES:

All patients were monitored and haemodynamic variables like heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, oxygen saturation were noted every 2 minutes for up to 20 minutes and there after every 5 minutes up to 60 minutes .

COMPARISON OF HEART RATE

Heart rate was observed and noted for every 2 minutes for 20 minutes and there after every 5 minutes up to 60 minutes. The mean heart rates of all three groups are comparable. The mean heart rate of leg wrapped group (BLW) was stable in intraoperative period throughout. Increase in mean heart rate observed in both leg elevation (BLE) and control group (BC). The mean heart rates in all three groups are shown in table 3. (Figures 11, 12)

FIGURE 11:COMPARISON OF HEART RATE : 0 TO 20 MINUTES

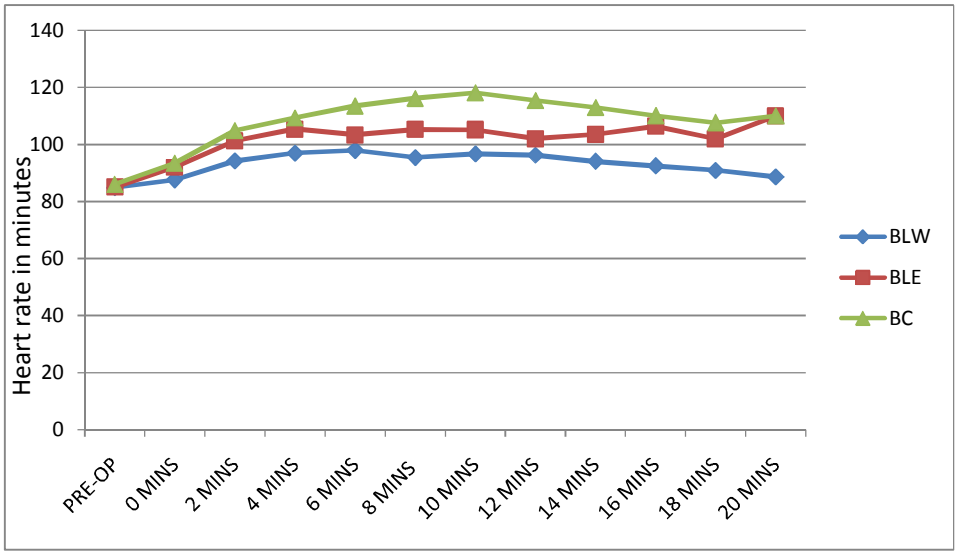


FIGURE 12:COMPARISON OF HEART RATE 20 TO 60 MINUTES

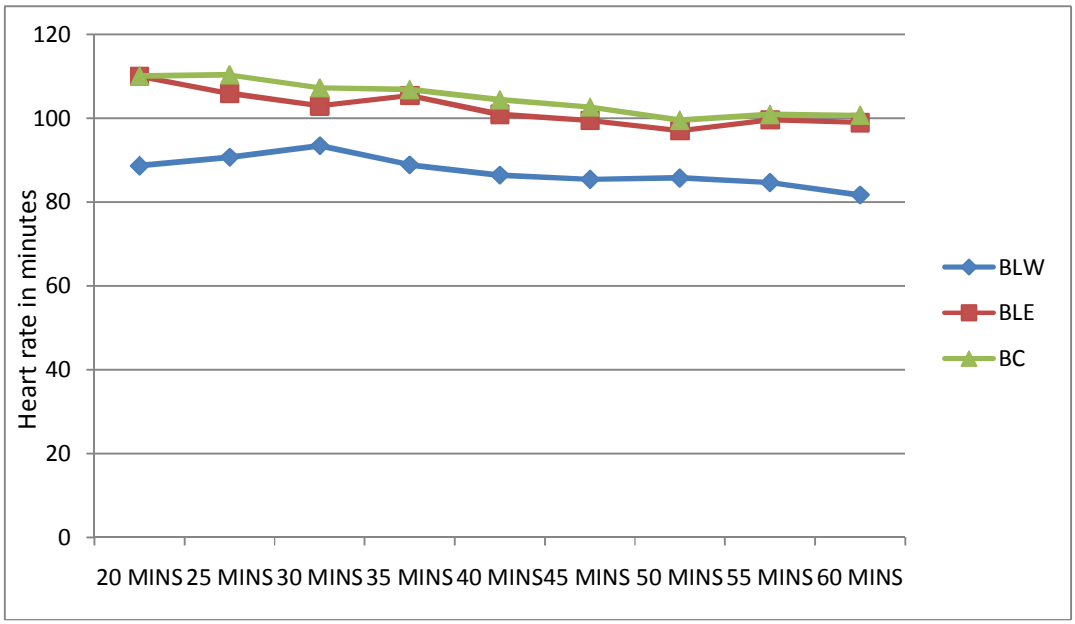


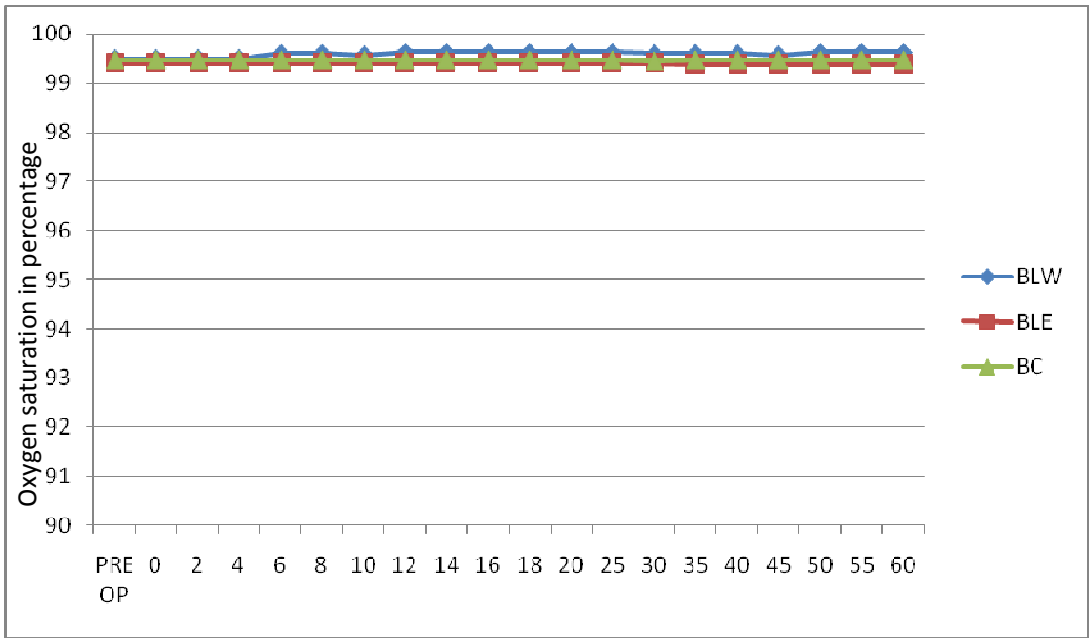
TABLE 3: COMPARISON OF MEAN HEART RATE

TIME (MINS)	BLW	BLE	BC
PRE OP	84.83±8.917	85.00±8.325	86.00±6.04
0	87.60±12.87	92.00±14.3	93.40±7.021
2	94.17±12.9	101.23±15.54	104.83±7.59
4	96.93±13.23	105.37±15.73	109.27±8.01
6	97.93±11.98	101.57±15.91	113.47±8.043
8	95.43±11.33	100.20±14.97	116.1±8.286
10	96.60±11.66	105.10±14.81	118.10±8.231
12	96.17±12.91	101.97±14.85	115.37±8.38
14	94.03±12.72	103.53±14.83	112.93±8.42
16	92.47±12.89	106.37±15.46	110.03±8.34
18	90.90±12.93	101.93±15.19	107.63±8.56
20	88.63±12.88	109.97±16.18	110.00±8.87
25	90.67±13.13	105.97±16.91	110.33±8.91
30	93.47±13.13	102.90±17.03	107.23±9.18
35	88.90±13.91	105.40±17.28	103.83±9.35
40	86.43±14.32	106.93±17.32	102.37±9.365
45	85.40±13.79	108.47±17.4	100.63±9.31
50	85.73±13.51	105.43±17.48	98.50±9.37
55	84.67±13.22	102.60±17.59	97.07±9.65
60	81.70±12.97	100.27±17.71	96.00±9.715

COMPARISON OF MEAN SPO2:

During this study patients of all three groups maintained saturation of 99% to 100% . All patients were supplemented with oxygen 6litres per minute through face mask.There was no significant difference among the study groups**.[**Figure 13]

FIGURE 13: COMPARISON OF MEAN SPO2



SYSTOLIC BLOOD PRESSURE COMPARISON:

All patients were monitored intraoperatively and blood pressure was noted every 2 minutes for 20 minutes and there after every 5 minutes for 60 minutes .The mean blood pressure was comparable in all three groups. Significant difference in blood pressure was present in first 20 minutes. There after there is no significant difference among the groups.Mean systolic blood pressures are shown in table 4. (figure14,15

TABLE 4: COMPARISON OF BLOOD PRESSURE

TIME	MEAN SYSTOLIC BLOOD PRESSURE			MEAN OF MEAN ARTERIAL PRESSURE		
MINS	BLW	BLE	BC	BLW	BLE	BC
PRE-OP	122.93	123.03	125.00	94.03	96.54	98.27
0	117.17	113.80	115.43	88.57	90.07	89.73
2	113.1	105.53	103.93	85.20	83.70	83.93
4	107.07	100.47	95.87	85.37	78.40	77.37
6	111.53	97.77	97.17	83.97	75.67	76.47
8	111.53	100.90	96.50	84.23	78.97	74.93
10	111.2	100.73	100.97	82.50	80.73	79.67
12	111.93	103.33	102.77	84.47	79.10	82.13
14	110.50	103.27	102.50	87.50	81.93	84.97
16	111.77	105.83	102.83	87.33	84.37	80.57
18	113.87	103.37	102.53	82.53	79.90	79.23
20	111.63	102.07	102.70	79.93	78.03	78.07
25	111.43	104.43	104.37	77.53	77.70	78.63
30	110.90	106.73	106.43	79.4	81.27	82.27
35	111.53	107.97	108.77	80.97	82.47	86.23
40	113.20	107.40	112.23	82.73	85.53	88.67
45	113.10	108.77	113.64	81.90	83.97	90.73
50	113.13	110.93	115.93	83.00	83.73	91.40
55	114.03	113.08	117.14	84.77	86.50	93.30
60	116.30	115.17	119.09	85.63	88.73	95.13

FIGURE14: COMPARISON OF SYSTOLIC BLOOD PRESSURE 0 TO 20 MINUTES

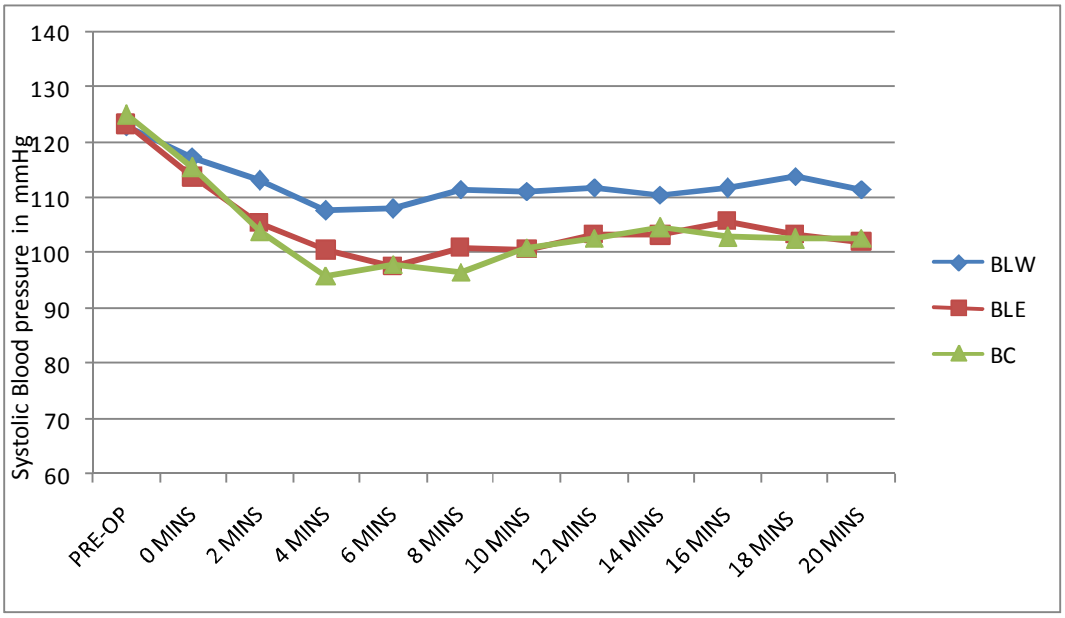
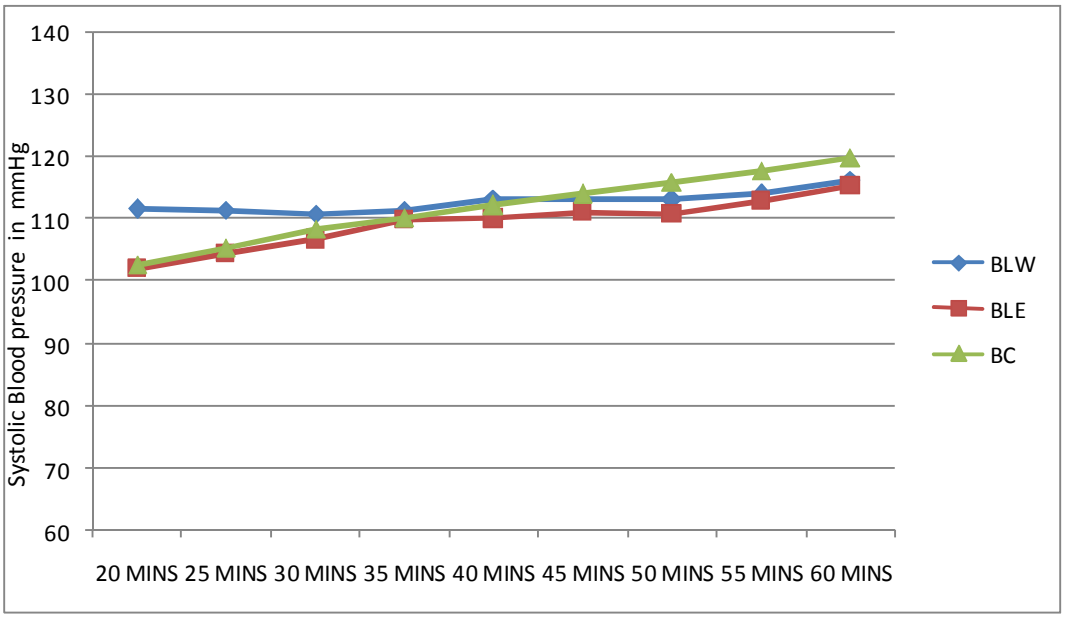


FIGURE15: COMPARISON OF SYSTOLIC BLOOD PRESSURE 20 TO 60 MINUTES



COMPARISON OF MEAN ARTERIAL PRESSURE:

Mean arterial blood pressure was noted in all three groups and were comparable. There is sinnificant fall in mean arterial pressure in leg elevation group and control group when compared to leg wrapping group in first 20 minutes. Then there was slow rise in mean arterial blood pressure with use of ephedrine in leg elevation and control groups. Mean arterial blood pressure values are shown in table 4.(figure 16,17)

FIGURE16:COMPARISON OF MEAN ARTERIAL BLOOD PRESSURE 0 TO 20 MINUTES

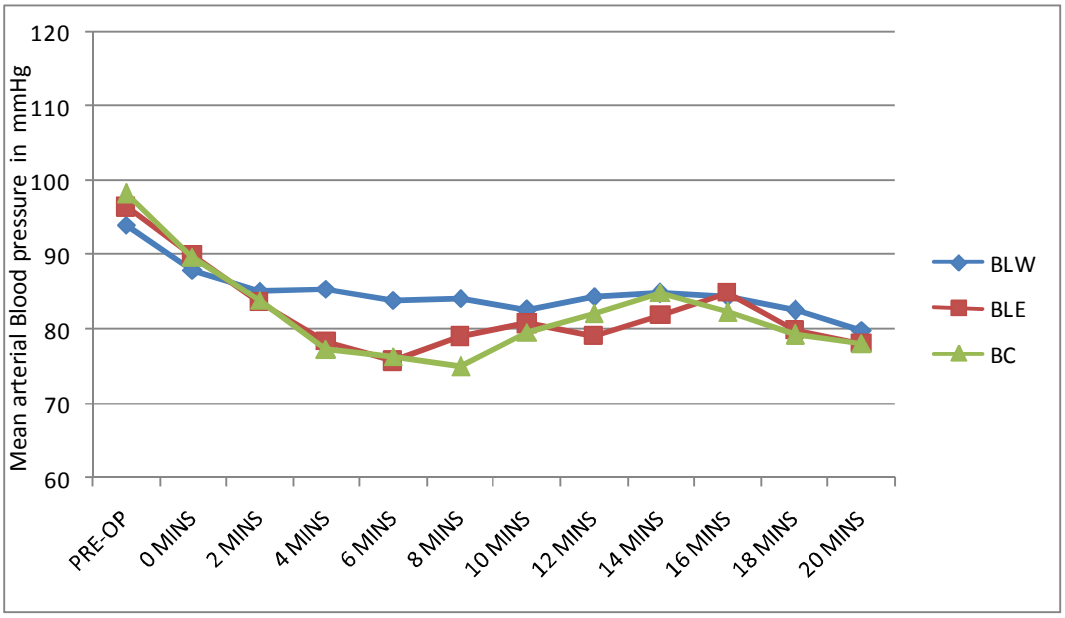


FIGURE17:COMPARISON OF MEAN ARTERIAL BLOOD PRESSURE 20 TO 60 MINUTES

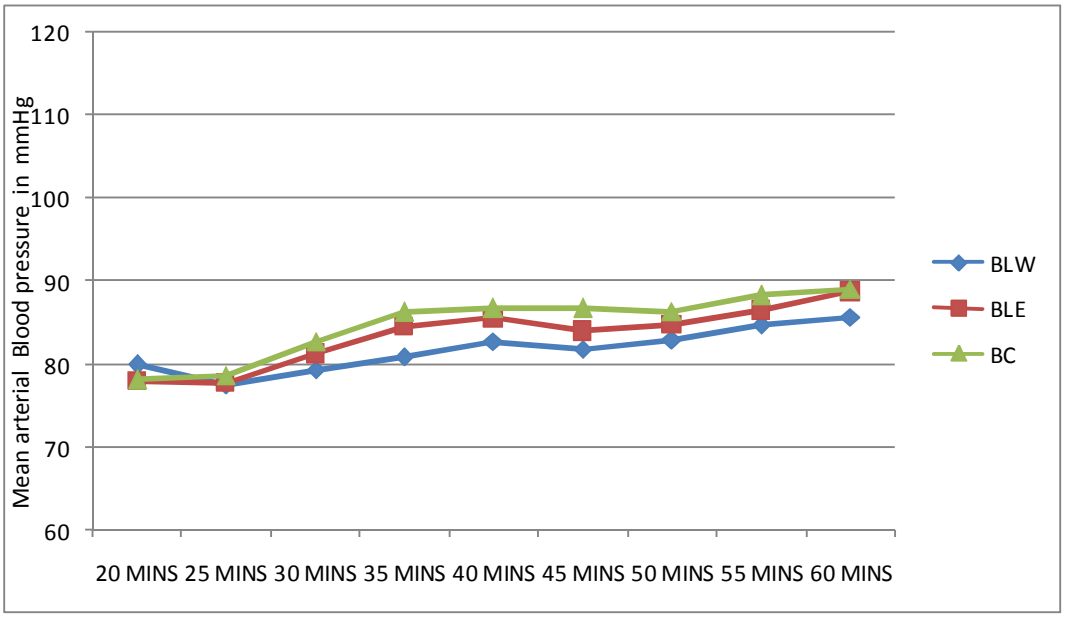


TABLE5: INCIDENCE OF HYPOTENSION:

GROUP	NO OF PATIENTS HYPOTENSION PRESENT	IN PERCENTAGE
BLW	3(30)	10%
BLE	10(30)	33.33%
BC	15(30)	50%

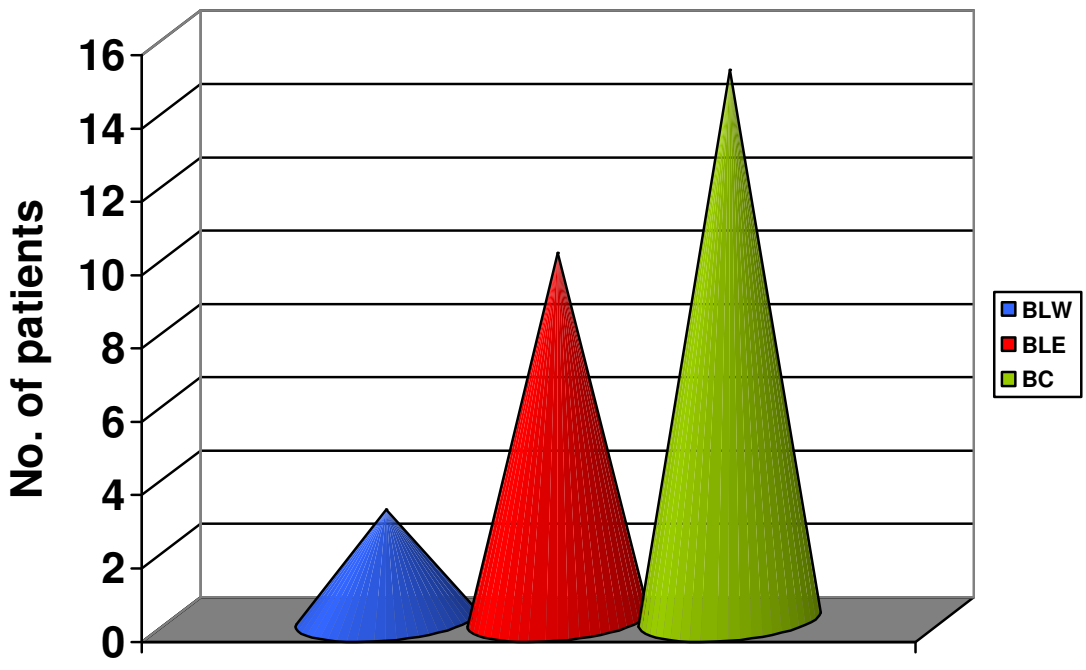
COMPARISON OF INCIDENCE OF HYPOTENSION

The blood pressure in leg wrapped group(BLW) was stable , fall in blood pressure noted in 3(10%) patients , compared to 10 (33.33%) patients in leg elevated group (BLE) and 15 patients in control group (BC). The difference in occurrence of hypotension in study groups were statistically significant . The chi-square score was 4.8118 and 'P' value was 0.0282 (< 0.05) when leg wrapped group BLW was compared with leg elevation group BLE. This was statistically significant. Similarly when leg wrapped group BLW was compared with control group BC , the chi-square score was 11.428 and the 'P' value was 0.0007 ,this result was also statistically and clinically significant. But when leg elevation group BLE was compared with control group BC , the chi-square score was 1.7143 and the 'p' value was 0.190 which was not significant statistically. (table 5,6; figure 18)

TABLE6: COMPARISON OF INCIDENCE OF HYPOTENSION

GROUPS	BLW (3) BLE (10)	BLW (3) BC (15)	BLE (10) BC (15)
Chi Squae value	4.8118	11.428	1.714
P value	0.0282 [<0.05]	0.0007 [< 0.05]	0.19 [>0.05]
SI	**SIGNIFICANT**	**SIGNIFICANT**	**NOT SIGNIFICANT**

FIGURE18: COMPARISON OF INCIDENCE OF HYPOTENSION



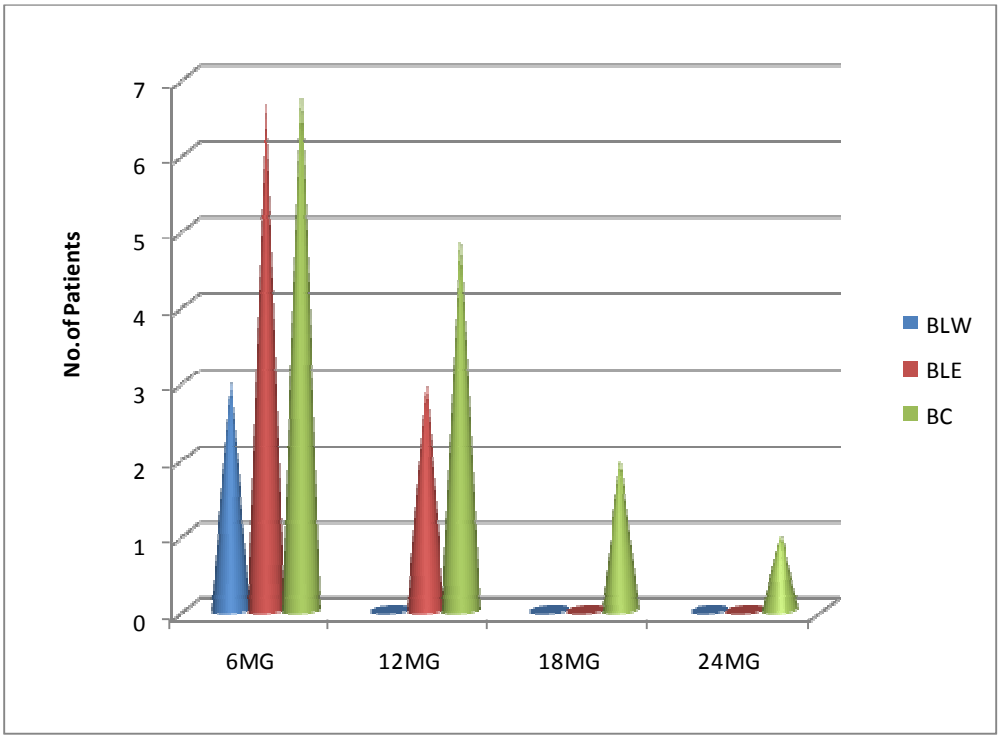
EPHEDRINE USAGE AMONG GROUPS

Ephedrine usage among groups were studied.In leg wrapped group ephedrine usage was 6mg in 3 patients,in leg elevation group ephedrine usage was 6mg in 7 patients,12mg in 3patients and in control group6mg in 7patients ,12mg in 5patients,18mg in 2patients and 2mg in 1patient.(table 7; figure 19)

TABLE7 : EPHEDRINE USAGE AMONG GROUPS

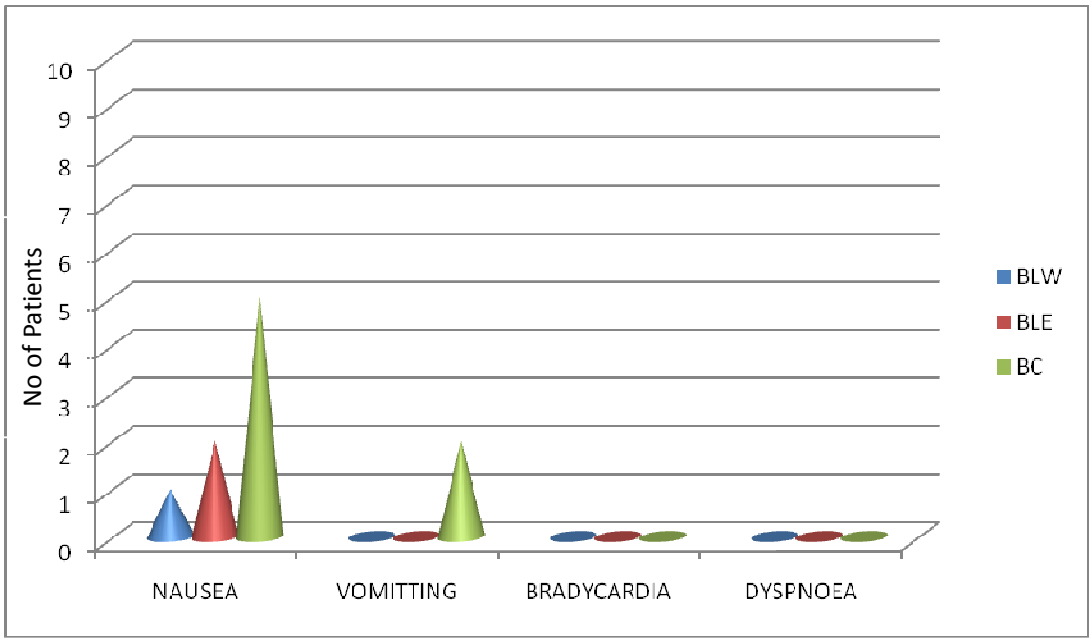
EPHEDRINE DOSE(mg)	BLW(NO.OF PATIENTS)	BLE(NO.OF PATIENTS)	BC (NO.OF PATIENTS)
6	3	7	7
12	-	3	5
18	-	-	2
24	-	-	1

FIGURE19 : EPHEDRINE USAGE AMONG GROUPS



COMPARISON OF SIDE EFFECTS:

FIGURE 20:COMPARISON OF SIDE EFFECTS



During this study patients were observed for any untoward side effects like nausea, vomiting , bradycardia ,dyspnoea.. In leg wrapped group BLW 1 patient had nausea ,in leg elevation group BLE 2 patients had nausea and in control group 5 patients had nausea and 2 patients had vomiting . None had vomiting in BLW and BLE group. This was not statistically significant. Similarly none had bradycardia or dyspnoea in all three groups.(Figure 20)

DISCUSSION

Spinal anaesthesia causes sympathetic blockade. Sympathetic blockade results in hypotension due to arteriolar vasodilation (decrease in systemic vascular resistance i.e.afterload) and venous pooling in peripheries (decrease in venous return i.e preload). Hypotension causes hypoperfusion of the uterus and placenta. The degree of cephaloid spread of local anaesthetic drug in subarachnoid space determines the extent of sympathetic block[66]. In parturients, greater sensitivity to local anaesthetics and effects of aortocaval compression results in higher level of blockade, so hypotension occurs with greater frequency and severity. In parturients due to greater degree of peripheral vasodilation more venous pooling occurs in lower extremities[67]. This vasodilation leads to pooling of around 500 to 600 ml of blood to peripheral compartment, thus venous return decreases consequently leading to decrease in cardiac output[68]. Parturients have more sensitive baroreceptor response. Baroreceptor activity leads to increase in heart rate as a response to hypotension. Bradycardia can also occur during high spinal anaesthesia.

Management of spinal hypotension is always a challenge to obstetric anaesthesiologist because of dual concern of both mother and foetus. Various methods were studied for prevention of spinal hypotension.

Non-pharmacological methods for preventing hypotension have been historically popular because of concern that vasopressors might have detrimental effects on uteroplacental circulation. In obstetric anaesthesia use of left uterine displacement with wedge is routinely done to prevent aortocaval compression and this is also supported by history and tradition. Crawford demonstrated the importance of lateral tilt in a series of 150 cases of Caesarean section under general anaesthesia, when he found blood gases and Apgar scores were better when left lateral tilt was applied. Placing the patient in the full left lateral position after spinal injection has been shown to be associated with less hypotension and improved CO compared with the tilted supine position[69]. The main mechanical method described are lower limb compression by elastic compressive stockings, pneumatic stockings , Esmarch bandages or leg wrappings with crepe bandage. All these methods aim to maintain blood pressure by increasing venous return to the heart by minimizing venous pooling of blood in the legs or increasing the resistance of the peripheral circulation[70]. This augments venous return and has been shown to reduce the incidence of hypotension without compromising uteroplacental circulation. Hence better haemodynamic stability of mother and better foetal outcome.

Studies regarding pre-emptive vasopressor usage for prevention of spinal hypotension were also conducted but the risk of impaired foetoplacental perfusion secondary to vasoconstriction leading to foetal or neonatal consequences was a major limitation. Other factor is that absorption after intramuscular injection is unpredictable and higher dosage is required. Foetal academia evident by cord blood pH had caused decrease in usage of pre-emptive vasopressor[71].

The main contribution for spinal hypotension being venous pooling in abdomen and legs, we chose to investigate if leg wrapping prevents spinal hypotension in caesarean section. We also decided to compare leg elevation technique with leg wrapping for the same. The aim of our study was **"**To evaluate and compare the haemodynamicchanges, incidence of hypotension, need for usage of vasopressor in spinal anaesthesia for elective caesarean section between leg wrapping ,leg elevation and control group."

90 parturients were randomly assigned to the groups BLW (n=30), BLE (n=30) and BC (n=30) . In our study patients were comparable with regard to demographic data. There was no significant difference among all three groups on comparing age , weight, height and gestational age.

In our study we used bupivacaine at a dose of 0.06mg/cm of height. **Kunal et al[58]** had used 2.5ml of 0.5%hyperbaric bupivacaine for all patients in their study. We chose to use dosage according to height because mean height in their study was 164cm, but our study was conducted in south India where the average height was 152cm for female. In our study mean height was 149.97cm in BLW group, 150.83cm in BLE group and 151.20cm in BC group. Maximum spinal block level, time to reach maximum block, time from spinal to delivery of baby, time from delivery to end of surgery and total duration of surgery were also noted and compared. There was no significant difference among the groups with respect to this clinical data. There was no influence by leg elevation upon maximum block level or time to achieve maximum block level. In a study conducted by **CC.ROUT et al[63]** also they had concluded that leg elevation to 30˚ had not influenced block height.

INCIDENCE OF HYPOTENSION

In this study we observed that there is decrease in the incidence of hypotension and reduction in the requirement of rescue vasopressor ephedrine in the leg wrapping group (BLW) when compared to leg elevation (BLE) and control group (BC).

The incidence of hypotension in leg wrapped group (BLW) was 3 patients (10%) where as in leg elevated group (BLE) was 10 patients (33.33%) [P =0.0282] and in control group (BC) was 15 patients (50 %) [P =0.007]. This observation implies that leg wrapping prevents spinal hypotension significantly when compared to leg elevation and control. Leg elevation did not significantly reduce the incidence of hypotension. The requirement of rescue ephedrine was less in leg wrapped group (BLW), they required only single dose 6 mg intravenously where as in leg elevation group (BLE) requirement of rescue ephedrine was 12 mg iv and in control group (BC) the requirement of ephedrine was 18 to 24 mg iv .Thus the requirement of ephedrine was significantly low in leg wrapping group (BLW) when compared to leg elevation group and control group. Prophylactic effect of leg wrapping in prevention of spinal hypotension has been already studied. **C.C.Rout et al**[63] also compared leg wrapping and leg elevation for prevention of spinal hypotension in elective caesarean section. In their study they concluded that elevatation and Leg wrapping with elastic esmarch bandage resulted in a significant reduction in the incidence of postspinal hypotension in comparison to the control group (18% compared to 53%, p = 0.004)**.** In their study they had concluded that leg elevation alone did not significantly reduce the incidence of' hypotension (39%).

They also concluded that there was no significant difference in the time of onset of hypotension between the groups. They also found that there was no significant difference in mean dose requirement of ephedrine between the groups. **Bhagwanjee S et al[64]** had compared twenty four parturients undergoing elective caesarean section who were randomly allocated to have their legs wrapped with elastic esmarch bandages immediately following spinal anaesthesia or to serve as controls and they also found that the incidence of hypotension was significantly less in leg wrapped group (16.7%) than in controls (83.3%) [P = 0.0033]. Similar results were found in study by **L.J.Van Bogaert et al[61]** who concluded that incidence of hypotension was significantly reduced by wrapping (15.8%) as compared to controls(45.5%) [p=0.012], elevation did not prevent hypotension [p-0.38]. **Nahed F., khedr et al[59]** has also concluded that wrapping and elevation of leg was more effective in preventing postspinal hypotension in parturients in elective caesarean section.

Kunal Singh et al[58] has also concluded that incidence of hypotension can be reduced by wrapping the legs with elastic crepe bandage with a subsequent reduction in the use of potent vasopressor (10%) compared to control group (33.33%) where wrapping was not done.

HEART RATE

In our study significant difference in heart rate was observed among the study groups .In leg wrapping group(BLW) heart rate was stable before and after delivery, where as there was rise in heart rate in both leg elevation group (BLE) and control group (BC) before delivery of baby .After delivery in both groups (BLE and BC) there was slow fall in heart heart rate but still heart rate in leg elevation and control group was significantly higher when compared to leg wrapping group. This rise in heart rate might be a compensatory response to hypotension, the occurrence which was significantly higher in both BLE and BC groups and due to usage of ephedrine which was higher in BLE and BC groups. Similar results was observed by **Kunal Singh et al**[58] in his study ,where he concluded that rise in heart rate was observed in control group but not in leg wrapping group before delivery . In their study after delivery of baby there was no difference in heart rate and control group, but in our study there was significant difference in heart rate in BLE and BC group. This may be because we used ephedrine as rescue vasopressor whereas in their study they used phenylephrine as rescue vasopressor.

SYSTOLIC BLOOD PRESSURE

In our study there was decrease in mean systolic blood pressure in leg elevation and control group especially at 4,6,8,10th minutes ,that was before and during delivery. After delivery slow rise in systolic blood pressure and was stable there after. No significant fall in systolic bloodpressure below baseline was noted in leg wrapping group and the blood pressure was consistently maintained around base line .This observation could be explained by the concept that around 500 to 600 ml blood reaches peripheral circulation during vasodilation caused by spinal anaesthesia. In leg wrapping group this peripheral venous pooling is prevented by the tight compression of lower limbs by crepe bandage .Also this compression of lower limb offers resistance and thus increase in systemic vascular resistance also contributes to prevention of hypotension. Thus there occurs increase in venous return and increase in systemic vascular resistance explaining the reason for reasonably stable blood pressure during spinal anaesthesia. In leg elevation group, leg elevation to 30˚ was not sufficient to push the peripheral pooled blood to central circulation, as the vasodilation in post spinal anaesthesia was intense that it needs higher compressive pressure to increase venous return.

In control group significantly higher incidence of hypotension occurred because of this peripheral venous pooling of blood which decreases venous return and also spinal anaesthesia causes vasodilation leading to decrease in systemic vascular resistance. In a study conducted by **Kunal Singh et al**[58] also they observed that there was a decrease in systolic blood pressure following spinal anesthesia, which was significantly lower than the baseline value at 4, 6th, 8th, and 10 min and was not significant thereafter. Finding of the present study also correlate with the study done by **C.C.Rout et al**[63] in which they showed that in leg wrapped group, the mean systolic blood pressure did not significantly decreased to below baseline value. Systolic blood pressure was significantly lower in the control group than in leg wrapped group at 3^{rd},4^{th},6^{th},7^{th},10^{th} minute following spinal injection. Similar results were observed by **van Bogaert et al**[61] who found that in all the groups, there was a decrease in systolic blood pressure, but the mean systolic blood pressure remained significantly above the systolic blood pressure of control.

MEAN ARTERIAL PRESSURE

In our study there was fall in mean arterial pressure from baseline in leg elevation group and control group at 4^{th}, 6th, 8th, 10th minute, but significant fall in mean arterial blood pressure was not noted in leg wrapping group. This is in agreement with the study done by **Kunal singh**

et al[58] where they had concluded that there was highly significant difference in the mean arterial blood pressure at 4^{th},6^{th},8^{th} minute. Fall in control group was significant where as in leg wrapping group there was not much significant fall in mean arterial pressure. In their study, **Adsumelli et al**[60] they found 50% higher incidence of significant mean arterial pressure reduction in the control group compared with the sequential compression device group.

EPHEDRINE USAGE

Ephedrine usage among groups was studied. In leg wrapped group ephedrine usage was 6mg in 3 patients, in leg elevation group ephedrine usage was 6mg in 7 patients, 12mg in 3patients and in control group6mg in 7patients, 12mg in 5patients, 18mg in 2patients and 2mg in 1patient. Total ephedrine usage in leg wrapped group was 18mg, in leg elevation group it was 78mg and in control group it was 162mg.

SIDE EFFECTS

During this study patients were observed for any untoward side effects like nausea, vomiting, bradycardia, dyspnoea. In leg wrapped group BLW one patient had nausea ,in leg elevation group BLE two patients had nausea and in control group five patients had nausea and two patients had vomiting.. None had vomiting in BLW and BLE group. This was not statistically significant. Similarly none had bradycardia or dyspnoea in all three groups.

LIMITATION OF THE STUDY

In this study we observed and analysed the haemodynamic changes in parturients.

Foetal outcome was not studied.

SUMMARY

90 full term parturients with singleton uncomplicated pregnancy belonging to American Society of Anesthesiologist (ASA) Class I or II, scheduled for elective caesarean section under spinal anesthesia were allocated randomly to either leg wrapping group BLW (n = 30) or leg elevation group BLE (n = 30) or control group BC(n = 30).

Leg wrapping group patients (n = 30) had their lower limbs wrapped just before the administration of the subarachnoid block. Leg wrapping was achieved with crepe bandage (15 cm width, 4 m stretched length) applied from the ankle to the mid-thigh in both legs; during wrapping lower extremities were lifted at an angle of 45°. The crepe bandages were wrapped tightly enough that the women felt the tightness, yet it was comfortable and not painful. Leg elevation group patients had their leg elevated immediately after spinal anaesthesia such that they were at an angle of 30˚ to the horizontal plane. Control group patients had their lower limbs neither raised nor wrapped.

Baseline blood pressure and heart rate were measured in supine wedged position. Intravenous fluid preloading was then done with 20 ml/kg of ringer lactate solution over 15 to 20 min just prior to the spinal anesthesia in all patients.Under all aseptic precaution spinal anesthesia was performed

in all patients in the sitting position using a 25Gauge Quincke's spinal needle in the L3-L4 interspace through midline approach. All patients were given injection 0.5% hyperbaric bupivacaine in the dose of 0.06mg/cm of height. Thereafter, the patients were placed supine wedged position.

They were evaluated and observed for incidence of hypotension, variability in heart rate, requirement of ephedrine, time for onset of block, time to delivery, duration of surgery and side effects. The collected data were analysed using Analysis of Variance and chi-square test, significant if $P<0.05$.

Leg wrapping group showed decreased incidence of hypotension when compared to leg elevation ($P=0.0282$) and control group ($P=0.0007$). Requirement of ephedrine is very less in leg wrapping group as compared to leg elevation and control group. Haemodynamic stability was better maintained in leg wrapping group compared to leg elevation and control group.

CONCLUSION

We conclude that the leg wrapping with elastic crepe bandage just before subarachnoid block significantly decreases the incidence of spinal hypotension as well as it causes a marked reduction in the use of vasopressor agents when compared to leg elevation and control groups. Thus leg wrapping technique eventually results in better maintenance of uteroplacental circulation and foetal outcome. As leg wrapping with elastic crepe bandage is cheap, easy, readily available, and non-invasive this technique can be recommended along with other routinely used methods like left uterine displacement with wedge for preventing spinal hypotension and for better maternal and foetal care.

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PROFORMA

Name: Age: IP No:

Height: weight: Gestation age:

Diagnosis: Procedure:

Preop:

PR: CVS: Airway:

BP: RS:

SPO2: CNS:

INVESTIGATIONS:

Hb : RBS: Urea:

Creatinine: ECG: **ASA:**

Anaesthesia: **SAB**

GROUP: BC/BLE/BLW

Position : space: Needle:

Dose:

Time between spinal to delivery[min]:

Time between delivery to end of surgery[min]:

Total duration of surgery[min]:

Maximum sensory block height:

Time to maximum sensory block height[min]:

INTRA OP:

	0	2	4	6	8	10	12	14	16	18	20	25	30	35	40	45	50	55	60	65
HR																				
SBP																				
DBP																				
MBP																				
SPO2																				
EPH																				

Side effects

Hypotension :

Nausea :

Vomitting :

Bradycardia :

Dyspnoea :

S.NO	NAME	AGE(YEARS)	WEIGHT (KG)	HEIGHT(CM)	DIAGNOSIS	GESTATIONAL AGE(WEEKS)	GROUP	PRE-OP HR(MINS)	HR 0 MINS	HR 2 MINS	HR 4 MINS	HR 6 MINS	HR 8 MINS	HR 10 MINS	HR 12 MINS	HR 14 MINS	HR 16 MINS	HR 18 MINS	HR 20 MINS	HR 25 MINS	HR 30 MINS	HR 35 MINS	HR 40 MINS	HR 45 MINS	HR 50 MINS	HR 55 MINS	HR 60 MINS	PREOP SBP
1	PUNITHA	31	55	148	G2P1L1/PREVIOUS LSCS	37	BLW	96	101	106	109	111	109	110	108	105	103	101	99	100	103	88	84	87	89	86	82	130
2	DHANALAKSHMI	21	54	149	G2P1L1/PREVIOUS LSCS	38	BLW	101	115	119	123	115	112	114	123	122	121	119	117	118	120	100	98	100	92	92	86	128
3	SUGANTHI	24	57	152	G2P1L0/PREVIOUS LSCS	37	BLW	86	95	104	107	102	96	98	106	103	101	100	98	101	105	72	70	68	64	61	60	110
4	MAHALAKSHMI	22	59	159	G3P2L2/PREVIOUS LSCS	38	BLW	81	82	87	88	90	87	89	88	85	84	83	82	85	88	85	84	81	86	89	79	130
5	JAYASREE	24	52	145	PRIMI/CPD	38	BLW	88	78	88	102	99	101	96	92	89	93	87	86	89	90	89	91	88	83	88	87	120
6	JAGADHAMBAL	30	60	160	G3P2L2/PREVIOUS LSCS	38	BLW	90	92	100	102	103	100	102	100	97	96	94	92	93	95	98	67	86	96	97	90	120
7	NIVEDHA	23	63	142	PRIMI/CPD	37	BLW	86	95	99	101	112	108	101	100	99	96	94	91	93	97	103	103	97	102	98	96	126
8	AKILANDESHWARI	30	57	145	G2P1L1/PREVIOUS LSCS	38	BLW	84	80	90	92	94	92	93	92	89	86	84	83	85	88	70	70	78	82	85	84	132
9	USHARANI	21	59	154	G3P2L1/PREVIOUS 1 LS	38	BLW	76	78	85	87	89	86	87	86	85	84	82	81	83	85	90	86	71	79	80	69	120
10	ANUSIYA	24	55	141	G2P1L1/PREVIOUS LSCS	37	BLW	89	85	88	91	93	91	92	91	90	87	86	83	84	86	74	70	68	70	74	70	110
11	MARIYAMMAL	29	52	149	G2P1L1/PREVIOUS LSCS	37	BLW	102	106	114	116	112	108	112	115	113	112	111	107	109	112	109	108	106	104	101	99	124
12	SASIKALA	22	63	151	PRIMI /POST DATED	40	BLW	98	101	105	108	109	108	109	107	105	103	102	101	104	106	103	101	100	98	95	94	120
13	LAKSHMI	21	62	156	G2PIL1/PREVIOUS LSCS	38	BLW	97	112	121	124	126	123	125	123	120	119	118	115	118	120	119	117	116	113	111	109	120
14	RUBADEVI	27	66	148	G4P3L2/PREVIOUS LACA	37	BLW	96	75	84	86	88	86	87	86	85	83	81	79	80	83	82	80	78	76	74	73	128
15	PREMA	22	52	145	G2A1/CPD	37	BLW	78	74	78	81	82	79	81	79	77	75	74	73	74	77	76	74	72	98	103	99	120
16	JAYASELVI	20	55	148	G2P1L1/PREVIOUS LSCS	37	BLW	78	109	114	116	114	105	108	115	112	110	108	107	110	114	113	112	111	109	106	103	126
17	MARAGADHAM	31	54	149	G2P1L1/PREVIOUS LSCS	37	BLW	100	73	78	79	81	80	82	81	80	78	77	76	77	79	75	74	73	71	69	67	128
18	SEETHALAKSHMI	30	57	152	G3P2L1/PREVIOUS 1 LS	38	BLW	76	84	88	91	93	90	92	91	90	89	88	84	86	90	87	86	85	84	81	80	122
19	SARITHA	23	59	159	G2P1L1/PREVIOUS LSCS	37	BLW	85	86	94	95	97	94	95	94	92	90	88	85	87	91	90	88	86	83	81	80	120
20	NIROSHA	20	52	145	PRIMI/CPD	38	BLW	78	92	100	103	105	102	104	103	101	100	98	94	97	101	98	97	96	95	93	90	124
21	NIVEDHA	28	60	160	G3P2L2/PREVIOUS LSCS	38	BLW	94	79	86	89	90	87	89	88	85	83	82	80	83	86	85	83	82	79	78	75	130
22	VALLI	19	63	142	PRIMI/CPD	37	BLW	74	73	81	84	86	85	86	85	82	80	79	78	79	81	80	79	77	75	72	69	124
23	VANITHA	27	57	145	G2P1L1/PREVIOUS LSCS	38	BLW	80	76	84	86	88	87	88	87	85	83	82	78	80	83	79	78	77	75	73	72	120
24	SEETHALAKSHMI	28	59	154	G3P2L1/PREVIOUS 1 LS	38	BLW	86	92	101	103	104	102	103	101	100	99	98	97	100	102	100	99	97	94	93	90	108
25	RENUKA	26	55	151	G2P1L1/PREVIOUS LSCS	38	BLW	88	70	72	74	76	75	77	75	73	71	70	68	70	74	70	68	66	65	64	63	126
26	MARY	27	52	149	G2P1L1/PREVIOUS LSCS	38	BLW	76	89	93	97	98	96	98	96	94	92	91	88	91	93	89	88	86	85	82	80	128

S.NO	NAME	AGE(YEARS)	WEIGHT (KG)	HEIGHT(CM)	DIAGNOSIS	GESTATIONAL AGE(WEEKS)	GROUP	PRE-OP HR(MINS)	HR 0 MINS	HR 2 MINS	HR 4 MINS	HR 6 MINS	HR 8 MINS	HR 10 MINS	HR 12 MINS	HR 14 MINS	HR 16 MINS	HR 18 MINS	HR 20 MINS	HR 25 MINS	HR 30 MINS	HR 35 MINS	HR 40 MINS	HR 45 MINS	HR 50 MINS	HR 55 MINS	HR 60 MINS	PREOP SBP
27	AYISHABANU	25	63	151	PRIMI /POST DATED	39	BLW	82	97	106	107	109	107	109	107	106	104	102	98	100	103	99	98	96	95	93	91	130
28	GOMATHI	30	62	156	G2PIL1/PREVIOUS LSCS	38	BLW	89	93	97	100	101	100	102	100	97	96	94	93	94	98	96	95	93	91	88	85	126
29	LATHA	29	66	148	G2P1L1/PREVIOUS LSCS	37	BLW	74	75	84	85	87	85	86	84	81	78	77	73	74	76	73	72	70	69	65	62	122
30	SAVITHA	23	52	146	PRIMI/CPD	37	BLW	72	71	79	82	84	82	83	82	79	78	77	73	76	78	75	73	71	70	68	67	116
31	SHOBANA	26	58	148	G2P1L1/PREVIOUS LSCS	38	BLE	86	87	100	106	112	111	109	101	103	105	102	110	105	101	105	107	109	107	103	100	120
32	ANNAKAMATCHI	25	54	149	G3P1L1A1/PREVIOUS LS	38	BLE	88	110	122	127	124	122	125	123	124	128	122	128	125	123	126	127	128	125	122	121	130
33	VANITHA	31	57	152	G3P2L2/PREVIOUS LSCS	38	BLE	87	109	114	119	116	114	116	113	114	116	111	115	113	109	111	112	113	111	109	108	122
34	CHANDRAKALA	27	59	159	G2P1L1/PREVIOUS LSCS	38	BLE	101	96	105	108	100	98	105	102	104	106	101	108	106	102	104	106	107	104	100	97	126
35	JAYASHREE	24	52	153	PRIMI /POST DATED	40	BLE	87	100	108	111	112	106	109	107	109	112	104	115	113	110	113	115	116	113	109	108	130
36	JOTHI PAULIN	21	60	160	G2P1L1/PREVIOUS LSCS	38	BLE	92	110	124	127	122	119	126	123	125	131	128	138	135	132	135	137	139	137	135	134	116
37	IRUVI	19	63	145	G2A1/CPD	37	BLE	89	71	83	89	85	83	89	86	88	92	87	97	94	91	92	94	96	92	88	87	118
38	SHANTHI	25	57	148	G2P1L1/PREVIOUS LSCS	38	BLE	70	94	99	103	100	96	104	102	103	109	104	114	110	108	111	113	115	111	108	104	124
39	RANJANI	30	59	154	G3P1L1A1/PREVIOUS LS	38	BLE	86	87	95	98	92	90	97	94	95	99	94	99	97	94	97	99	100	98	96	94	128
40	KANAKA	29	55	146	G2P1L1/PREVIOUS LSCS	38	BLE	90	92	94	97	98	102	108	86	88	91	89	99	92	88	89	91	92	88	85	84	126
41	VASUKI	31	55	149	G2P1L1/PREVIOUS LSCS	38	BLE	85	89	102	105	103	107	108	105	106	110	104	116	111	107	109	111	113	111	109	106	116
42	KANCHANA	27	63	151	G2P1L1/PREVIOUS LSCS	38	BLE	87	102	113	118	110	106	112	109	111	115	113	122	120	117	120	122	124	122	120	117	130
43	SASIKALA	25	62	156	G2P1L1/PREVIOUS LSCS	37	BLE	102	86	100	106	100	98	102	100	102	106	104	113	109	105	107	109	111	109	106	105	130
44	UMADEVI	27	66	148	G4P2L2A1/PREVIOUS LS	38	BLE	82	93	105	108	106	104	109	107	109	112	106	112	108	105	109	110	111	109	105	103	120
45	SATHYA	31	52	149	G2P1L1/PREVIOUS LSCS	38	BLE	85	80	88	92	88	85	93	91	93	97	89	98	92	90	92	93	95	92	88	84	124
46	JAYA	31	55	148	G2P1L1/PREVIOUS LSCS	38	BLE	75	72	77	81	76	72	80	78	79	82	76	81	79	76	79	80	82	78	75	74	128
47	KRITHIKA	25	54	149	G2P1L1/PREVIOUS LSCS	37	BLE	70	70	80	82	80	89	92	96	99	92	89	89	82	80	81	82	83	80	77	75	118
48	SELVI	20	57	152	G3P2L2/PREVIOUS LSCS	37	BLE	93	110	120	125	122	120	126	123	124	127	122	130	126	124	128	129	131	127	123	120	122
49	RADHIKA	31	59	159	G2P1L1/PREVIOUS LSCS	38	BLE	89	115	129	135	131	129	134	131	133	135	133	143	139	137	139	140	142	138	136	134	118
50	CHITRA	25	56	145	G2P1L1/PREVIOUS LSCS	38	BLE	81	85	98	101	96	92	98	95	96	101	99	101	96	92	94	96	97	93	90	86	130
51	HAIJA NAZRIYA	24	60	160	G2P1L1/PREVIOUS LSCS	38	BLE	76	78	82	86	82	80	83	80	81	85	79	88	82	80	83	84	85	81	79	78	120
52	KAVITHA	30	63	149	G2P1L1/PREVIOUS LSCS	38	BLE	94	120	128	131	123	119	122	119	120	123	117	123	120	118	121	123	124	120	117	114	126

S.NO	NAME	AGE(YEARS)	WEIGHT (KG)	HEIGHT(CM)	DIAGNOSIS	GESTATIONAL AGE(WEEKS)	GROUP	PRE-OP HR(MINS)	HR 0 MINS	HR 2 MINS	HR 4 MINS	HR 6 MINS	HR 8 MINS	HR 10 MINS	HR 12 MINS	HR 14 MINS	HR 16 MINS	HR 18 MINS	HR 20 MINS	HR 25 MINS	HR 30 MINS	HR 35 MINS	HR 40 MINS	HR 45 MINS	HR 50 MINS	HR 55 MINS	HR 60 MINS	PREOP SBP
53	RAMYA	23	57	145	G2P1L1/PREVIOUS LSCS	37	BLE	82	85	91	97	93	89	93	89	91	94	89	99	93	91	93	94	95	93	91	87	128
54	MALARKODI	29	59	154	G3P1L1A1/PREVIOUS LS	38	BLE	86	93	98	103	97	94	101	98	99	101	96	107	105	102	103	104	106	103	101	97	130
55	KEERTHANA	22	55	145	PRIMI/CPD	38	BLE	73	77	86	88	86	93	90	89	89	94	90	100	98	94	96	97	99	96	94	90	124
56	ABSENTORNISHA	29	52	149	G2P1L1/PREVIOUS LSCS	39	BLE	88	102	116	119	114	110	118	116	118	123	118	130	125	121	123	125	126	123	120	117	128
57	KANNIAMMAL	23	63	151	G2P1L1/PREVIOUS LSCS	37	BLE	94	113	123	128	126	124	132	130	131	134	127	139	136	134	137	138	140	136	134	133	123
58	SEVAKIYAM	19	62	156	PRIMI /POST DATED	37	BLE	74	78	89	95	87	83	91	87	89	91	88	95	92	88	92	94	95	93	91	87	110
59	JHANSI	29	66	148	G2P1L1/PREVIOUS LSCS	38	BLE	72	80	88	92	89	85	93	90	91	96	89	98	92	88	91	93	95	92	89	88	120
60	KALA	21	52	148	G2P1L1/PREVIOUS LSCS	37	BLE	86	76	80	84	77	86	88	89	92	84	88	92	82	80	82	83	85	81	78	76	114
61	SATHYA	28	57	148	G2P1LI/PREVIOUS LSCS	37	BC	90	91	99	103	105	107	110	105	102	99	97	99	103	97	92	90	89	87	86	84	120
62	NADHIYA	20	54	149	G2P1LI/PREVIOUS LSCS	37	BC	87	86	100	103	106	108	111	107	104	101	98	100	105	99	96	93	92	89	86	85	124
63	PRIYA	21	57	152	G2P1LI/PREVIOUS LSCS	38	BC	88	93	103	108	113	117	119	116	115	113	109	111	116	114	108	105	103	102	99	98	122
64	NILOFER NISHA	21	59	159	G2P1LI/PREVIOUS LSCS	38	BC	84	88	102	106	112	114	117	115	114	112	109	113	117	113	108	105	103	100	97	95	130
65	MANIMEGALAI	26	52	155	G2P1LI/PREVIOUS LSCS	38	BC	82	99	107	113	118	121	118	117	112	108	109	111	104	100	101	99	94	92	94	90	126
66	MARIYAMMAL	19	60	160	G2P1LI/PREVIOUS LSCS	37	BC	86	108	118	123	128	130	122	120	116	118	112	108	109	105	103	100	103	100	98	92	122
67	DEEPA	28	63	149	G2P1LI/PREVIOUS LSCS	38	BC	78	97	106	109	112	115	119	115	113	110	107	111	114	112	108	106	104	101	100	99	124
68	ALLIRANI	20	57	146	PRIMI/CPD	37	BC	71	84	96	102	107	109	113	111	110	107	104	108	111	108	103	101	99	98	97	96	120
69	MADHAVI	29	59	154	G2P1LI/PREVIOUS LSCS	38	BC	89	104	108	114	127	130	134	130	127	123	121	124	126	123	117	115	113	112	111	111	122
70	MAABSENTNMANI	20	55	151	G2P1LI/PREVIOUS LSCS	38	BC	91	95	105	107	111	113	117	114	111	107	104	106	111	105	99	97	95	94	92	92	130
71	SARITHA	25	56	149	G2P1LI/PREVIOUS LSCS	37	BC	86	91	106	112	115	117	119	116	113	109	106	108	111	109	106	104	103	102	100	100	128
72	LALITHA	26	63	151	G2P1LI/PREVIOUS LSCS	37	BC	87	84	92	94	99	102	106	104	103	99	97	99	103	97	93	90	89	88	85	84	124
73	KALAIMANI	31	62	156	G2P1LI/PREVIOUS LSCS	38	BC	98	100	114	118	124	128	132	130	127	119	118	117	112	108	111	108	106	100	103	101	130
74	ANUSHYA MARY	26	64	148	G3P2L2/PREVIOUS LSCS	37	BC	76	86	102	107	109	112	115	112	110	106	103	105	109	105	100	98	96	95	94	93	126
75	FATHIMA BEEVI	21	52	147	G2P1LI/PREVIOUS LSCS	37	BC	89	98	114	119	124	126	124	118	112	110	110	114	108	106	105	110	102	100	98	96	132
76	NITHYA	26	55	148	G2P1LI/PREVIOUS LSCS	38	BC	90	96	112	115	119	123	125	121	118	116	113	116	112	114	109	107	105	104	103	101	128
77	VIMALA	25	54	149	G2P1LI/PREVIOUS LSCS	37	BC	87	97	108	112	115	119	123	119	116	112	109	111	113	108	105	103	102	99	98	98	130
78	RANI	19	57	152	G3P2L2/PREVIOUS 2 LS	37	BC	79	88	96	101	106	110	113	108	106	104	101	104	109	107	104	101	99	97	96	95	126

S.NO	NAME	AGE(YEARS)	WEIGHT (KG)	HEIGHT(CM)	DIAGNOSIS	GESTATIONAL AGE(WEEKS)	GROUP	PRE-OP HR(MINS)	HR 0 MINS	HR 2 MINS	HR 4 MINS	HR 6 MINS	HR 8 MINS	HR 10 MINS	HR 12 MINS	HR 14 MINS	HR 16 MINS	HR 18 MINS	HR 20 MINS	HR 25 MINS	HR 30 MINS	HR 35 MINS	HR 40 MINS	HR 45 MINS	HR 50 MINS	HR 55 MINS	HR 60 MINS	PREOP SBP
79	REVATHY	31	59	159	G2P1LI/PREVIOUS LSCS	37	BC	80	86	94	99	101	103	106	103	100	98	94	96	99	95	91	89	87	84	81	80	130
80	MASUDHA BEGUM	25	58	145	G2P1LI/PREVIOUS LSCS	38	BC	87	87	102	105	108	111	115	112	110	108	106	110	112	107	103	100	98	96	95	94	118
81	NAGALAKSHMI	25	60	160	G2P1LI/PREVIOUS LSCS	37	BC	85	92	101	106	110	112	116	117	111	107	104	108	110	106	101	99	97	95	94	94	124
82	AMUDHA	19	63	145	PRIMI/CPD	38	BC	91	107	118	124	127	131	128	122	124	120	123	120	112	110	110	112	108	102	100	99	118
83	GEETHA	21	57	146	G2P1LI/PREVIOUS LSCS	38	BC	86	94	109	115	117	121	123	121	120	117	115	117	115	112	114	112	110	109	107	105	116
84	VIJAYA	30	59	154	G3L1L1A1/PREVIOUS LS	38	BC	77	88	100	105	108	111	114	112	111	109	105	109	107	110	105	102	101	99	96	95	126
85	KOKILA	24	55	152	G2P1LI/PREVIOUS LSCS	37	BC	87	99	107	112	118	122	125	120	118	116	113	117	112	108	106	104	112	109	107	107	128
86	VAIRAMANI	31	52	149	G3P2L1/PREVIOUS LSCS	37	BC	74	83	99	101	105	107	110	108	106	103	99	103	105	103	100	98	96	94	91	91	124
87	PAPPATHY	19	63	151	PRIMI/POST DATED	40	BC	76	97	112	117	123	125	128	125	122	120	118	121	123	117	108	113	111	108	107	107	124
88	KOMALA	26	62	156	G2P1LI/PREVIOUS LSCS	38	BC	85	91	106	108	114	117	119	117	115	112	110	114	116	113	108	106	104	102	100	99	122
89	RUBASELVI	22	66	148	G3P2L2/PREVIOUS LSCS	38	BC	90	103	115	121	123	125	120	118	111	108	109	112	104	112	109	108	100	99	98	97	126
90	BANU	27	54	148	G2P1LI/PREVIOUS LSCS	38	BC	89	92	94	99	100	97	102	108	111	110	106	108	102	94	92	96	98	98	99	102	130

S.NO	SBP 0 MINS	SBP 2 MINS	SBP 4 MINS	SBP 6 MINS	SBP 8 MINS	SBP 10 MINS	SBP 12 MINS	SBP 14 MINS	SBP 16 MINS	SBP 18 MINS	SBP 20 MINS	SBP 25 MINS	SBP 30 MINS	SBP 35 MINS	SBP 40 MINS	SBP 45 MINS	SBP 50 MINS	SBP 55 MINS	SBP 60 MINS	PREOP DBP	DBP 0 MINS	DBP 2 MINS	DBP 4 MINS	DBP 6 MINS	DBP 8 MINS	DBP 10 MINS	DBP 12 MINS	DBP 14 MINS	DBP 16 MINS	DBP 18 MINS	DBP 20 MINS	DBP 25 MINS	DBP 30 MINS	DBP 35 MINS
1	130	128	122	120	118	110	118	110	104	110	106	110	120	112	118	118	122	116	118	80	74	70	66	64	60	58	58	46	46	54	60	64	68	72
2	131	131	110	101	110	108	102	100	100	100	102	105	110	107	105	109	109	111	116	76	74	70	61	55	57	56	49	49	46	47	51	54	60	56
3	111	112	110	110	106	102	101	99	102	101	97	110	96	96	96	102	100	96	98	70	78	67	69	70	61	59	57	56	57	57	58	62	51	56
4	130	111	110	112	111	110	117	113	114	123	111	114	119	119	112	115	115	113	126	70	70	62	86	78	78	70	69	68	67	73	70	71	74	70
5	110	112	100	92	99	101	102	104	102	106	102	100	104	108	110	112	110	110	108	84	58	46	48	54	58	58	62	60	59	58	60	62	60	60
6	120	118	110	112	118	120	122	119	120	120	121	119	117	112	100	100	108	114	117	70	88	84	87	88	82	87	86	71	74	70	68	68	74	64
7	110	110	102	88	98	102	108	108	112	110	106	108	105	103	108	110	114	118	122	80	68	68	62	54	58	60	62	64	64	68	62	58	60	58
8	130	120	118	110	112	110	114	114	120	124	122	122	126	124	128	124	128	124	128	78	80	70	70	70	67	70	72	68	71	64	62	60	61	66
9	118	118	100	102	104	110	116	118	116	118	120	116	118	119	116	118	118	120	120	76	80	68	58	62	65	63	64	69	70	68	71	71	70	68
10	110	106	100	100	104	102	106	108	110	108	110	112	118	118	114	118	120	118	120	80	70	70	66	68	70	68	64	62	66	58	60	56	60	62
11	119	114	111	114	119	118	115	112	115	120	116	120	118	116	118	122	122	120	128	84	84	81	87	85	81	78	81	84	81	75	71	69	72	76
12	107	101	100	100	107	104	103	102	103	105	102	100	102	100	106	108	110	108	108	80	82	78	82	80	78	73	75	79	78	73	70	64	68	72
13	106	102	100	104	102	102	101	100	101	103	101	104	100	100	104	108	108	108	110	78	72	66	58	60	66	64	68	72	70	66	60	54	60	64
14	120	104	92	100	108	110	106	108	106	106	108	110	112	114	112	108	110	112	110	80	10	76	81	79	75	71	77	81	80	72	70	63	66	70
15	122	119	118	120	122	118	116	112	116	118	112	108	104	108	112	111	109	113	114	78	84	78	83	80	76	74	79	83	82	77	70	65	70	74
16	114	110	108	102	108	110	114	114	116	118	116	114	112	116	119	117	114	117	119	86	74	66	71	67	64	60	64	67	65	59	58	51	56	57
17	106	104	100	105	107	104	103	102	103	107	104	102	100	102	106	106	106	108	110	86	77	72	77	74	72	70	75	77	74	67	62	56	62	66
18	118	119	116	120	118	120	122	118	122	124	120	118	116	118	121	118	116	116	119	78	76	72	78	74	72	68	72	74	73	66	58	55	58	60
19	123	117	112	114	122	121	118	114	116	122	116	114	110	114	119	115	112	115	118	76	82	79	85	83	81	76	82	85	84	76	70	67	70	74
20	128	125	122	127	135	132	130	128	128	126	128	126	126	128	130	128	126	128	124	76	74	72	76	74	73	70	72	76	74	74	78	58	64	66
21	118	113	107	113	120	118	116	115	116	118	114	112	108	111	115	113	111	112	115	80	83	80	84	81	79	76	81	85	82	74	67	64	70	72
22	116	112	106	108	115	113	111	109	111	115	111	107	103	104	110	106	103	104	106	88	79	73	78	74	72	71	75	77	75	69	65	61	66	70
23	108	106	103	108	113	111	110	107	109	113	110	106	103	106	110	109	106	108	110	86	75	69	74	71	70	69	72	74	71	65	57	52	54	58
24	102	100	96	98	100	102	106	110	108	106	108	106	110	110	108	106	106	110	114	78	75	71	77	73	69	68	72	75	74	67	61	57	62	66
25	120	118	114	112	108	110	114	116	122	126	122	120	118	120	124	122	120	124	126	78	72	65	69	65	64	59	64	68	65	57	54	52	55	59
26	120	118	118	112	114	120	122	118	122	124	122	118	116	120	124	122	124	122	126	80	73	67	72	69	67	62	67	70	68	62	58	53	55	57

S.NO	SBP 0 MINS	SBP 2 MINS	SBP 4 MINS	SBP 6 MINS	SBP 8 MINS	SBP 10 MINS	SBP 12 MINS	SBP 14 MINS	SBP 16 MINS	SBP 18 MINS	SBP 20 MINS	SBP 25 MINS	SBP 30 MINS	SBP 35 MINS	SBP 40 MINS	SBP 45 MINS	SBP 50 MINS	SBP 55 MINS	SBP 60 MINS	PREOP DBP	DBP 0 MINS	DBP 2 MINS	DBP 4 MINS	DBP 6 MINS	DBP 8 MINS	DBP 10 MINS	DBP 12 MINS	DBP 14 MINS	DBP 16 MINS	DBP 18 MINS	DBP 20 MINS	DBP 25 MINS	DBP 30 MINS	DBP 35 MINS
27	124	110	106	104	108	108	106	110	106	108	108	110	110	108	108	106	108	110	110	86	70	68	74	71	70	67	69	72	69	62	55	49	54	58
28	120	118	114	118	116	120	120	118	118	116	120	118	112	118	124	122	124	126	126	78	74	69	75	72	71	69	74	78	77	73	65	63	65	69
29	120	116	110	112	116	114	116	110	114	116	112	116	118	118	116	118	116	118	120	88	86	80	86	82	79	76	82	84	81	76	72	67	70	73
30	104	101	96	101	108	106	103	99	101	105	102	98	96	97	103	102	99	102	103	80	81	79	85	82	79	78	81	84	82	78	76	71	77	81
31	101	94	90	96	98	100	102	104	102	106	103	106	106	108	106	108	110	110	112	86	74	63	59	55	59	63	60	64	66	60	57	55	59	65
32	124	108	102	100	100	102	97	96	98	90	86	88	90	91	88	89	92	96	99	88	80	75	68	62	68	71	66	70	74	68	65	64	67	69
33	110	92	88	94	96	96	98	98	100	94	90	95	100	103	101	104	109	112	116	86	82	78	72	70	75	78	73	77	81	75	73	72	77	79
34	118	111	107	102	105	101	105	103	106	97	91	93	97	99	96	98	102	104	107	78	76	69	60	54	60	62	59	64	68	61	58	56	60	67
35	127	119	115	112	115	113	116	114	117	113	108	112	114	117	113	117	123	125	129	86	82	71	66	64	68	70	64	67	71	64	62	61	67	72
36	100	96	90	86	90	92	90	92	94	85	80	86	91	93	91	94	100	102	104	82	71	67	59	53	57	60	56	63	65	61	58	56	62	68
37	109	102	98	96	98	94	100	100	103	93	87	90	95	96	93	98	102	106	109	78	72	63	58	55	57	61	55	59	63	57	55	54	59	65
38	121	117	111	107	111	106	108	110	113	105	101	107	111	112	109	113	116	120	124	86	82	73	68	65	70	74	68	75	78	70	66	65	69	74
39	125	116	106	102	104	102	104	114	117	110	107	113	118	121	118	119	123	126	129	88	88	81	73	69	75	79	74	77	79	71	68	66	71	75
40	120	112	108	102	100	112	114	114	121	111	107	111	115	117	116	118	122	124	128	84	80	69	65	61	66	69	63	66	70	62	60	59	61	67
41	101	96	94	86	92	90	92	94	96	98	102	106	104	108	106	109	110	108	110	84	84	80	75	70	73	77	72	78	80	73	72	71	75	79
42	112	106	104	100	102	98	103	101	104	102	106	106	108	108	110	110	112	114	116	88	80	80	73	71	75	78	73	76	79	72	70	69	73	75
43	119	115	111	104	110	106	110	106	110	103	98	103	105	106	103	107	110	112	116	86	86	81	71	65	68	72	68	72	76	68	64	62	64	67
44	113	106	100	96	99	96	101	100	104	105	108	100	103	105	106	106	109	112	114	80	87	77	69	66	71	75	73	79	83	75	74	73	77	84
45	103	96	88	98	98	100	102	100	102	104	106	108	110	112	108	109	110	112	110	82	84	79	73	71	76	78	76	81	84	76	73	72	75	79
46	125	118	114	110	112	115	119	116	118	113	108	111	114	116	113	116	119	121	125	86	76	66	56	52	57	59	54	59	63	59	57	55	58	60
47	111	105	102	97	101	98	101	97	101	108	106	106	108	104	109	110	107	110	110	86	79	74	71	67	68	64	74	76	78	74	71	69	75	80
48	115	106	100	100	104	100	103	99	103	99	100	108	109	108	110	112	112	114	116	88	78	72	63	59	62	64	60	62	64	59	56	54	58	65
49	106	98	86	92	96	96	98	98	100	102	104	102	108	109	108	110	110	108	114	84	76	83	79	73	77	81	75	80	84	78	77	75	81	86
50	125	110	104	105	108	110	114	114	118	118	116	118	120	122	118	120	122	126	120	88	83	80	72	70	76	78	75	77	81	73	71	69	73	78
51	111	104	100	98	98	100	102	103	102	98	100	104	102	104	108	108	109	112	115	88	82	81	72	70	73	75	72	76	78	72	71	70	73	77
52	106	101	96	94	94	96	101	98	101	102	104	106	106	104	108	107	108	112	116	86	74	62	56	54	59	61	58	61	64	60	57	56	60	64

S.NO	SBP 0 MINS	SBP 2 MINS	SBP 4 MINS	SBP 6 MINS	SBP 8 MINS	SBP 10 MINS	SBP 12 MINS	SBP 14 MINS	SBP 16 MINS	SBP 18 MINS	SBP 20 MINS	SBP 25 MINS	SBP 30 MINS	SBP 35 MINS	SBP 40 MINS	SBP 45 MINS	SBP 50 MINS	SBP 55 MINS	SBP 60 MINS	PREOP DBP	DBP 0 MINS	DBP 2 MINS	DBP 4 MINS	DBP 6 MINS	DBP 8 MINS	DBP 10 MINS	DBP 12 MINS	DBP 14 MINS	DBP 16 MINS	DBP 18 MINS	DBP 20 MINS	DBP 25 MINS	DBP 30 MINS	DBP 35 MINS
53	115	108	103	100	100	102	104	104	106	102	99	102	108	110	110	110	112	116	118	84	79	72	67	62	65	67	65	68	72	65	61	59	61	66
54	118	106	100	90	98	99	100	104	106	106	108	108	110	110	112	109	112	110	112	86	82	71	66	60	62	64	59	66	69	62	60	58	61	64
55	120	110	104	104	108	110	112	112	114	118	119	116	118	118	119	118	122	125	128	78	77	81	71	68	72	74	71	77	79	75	71	70	72	76
56	112	104	99	92	96	92	99	100	102	104	104	106	108	108	110	110	111	114	118	76	72	69	62	58	62	66	62	66	70	64	62	60	65	68
57	120	116	106	104	108	110	112	111	114	113	114	116	114	118	114	118	116	118	121	78	70	64	76	71	75	78	75	77	79	71	69	67	71	78
58	110	108	98	88	96	92	98	100	102	100	98	100	100	104	106	106	104	108	110	70	68	67	70	64	69	73	69	75	79	73	72	71	77	79
59	112	86	94	88	96	98	97	98	100	100	102	102	106	102	104	102	104	106	108	76	71	68	70	66	72	75	72	77	81	75	73	71	75	77
60	105	100	96	88	94	96	98	98	100	102	100	104	104	106	109	108	110	108	110	78	71	66	70	67	73	75	71	76	80	76	75	73	76	80
61	112	106	88	96	87	98	102	105	102	104	102	100	106	108	109	112	116	120	122	88	78	76	69	70	63	69	75	76	69	75	67	68	76	86
62	114	102	94	88	96	100	97	100	98	99	100	102	100	102	105	106	104	110	113	88	76	68	66	62	64	73	69	76	71	60	66	63	65	70
63	108	100	84	90	86	99	104	105	104	104	106	108	106	110	108	110	106	108	111	86	75	67	60	52	58	59	58	64	65	58	57	54	57	63
64	120	110	103	101	98	105	107	111	106	104	101	109	116	118	122	125	127	129	132	88	88	80	76	71	77	78	81	83	84	82	77	78	80	76
65	113	102	98	94	91	98	100	104	98	94	92	100	106	109	111	113	116	119	122	86	84	82	69	67	61	74	76	81	74	64	67	66	73	82
66	108	99	85	100	100	102	100	102	103	107	108	110	110	106	110	112	114	112	110	78	86	71	57	52	51	52	61	64	51	49	47	49	51	59
67	126	115	109	107	104	110	112	115	110	108	106	110	118	121	125	126	128	130	133	86	72	70	79	84	84	80	83	78	83	78	78	85	85	82
68	110	99	91	98	99	98	100	101	100	99	102	103	104	104	107	109	114	116	114	80	72	74	67	68	62	65	77	77	67	65	61	66	72	69
69	121	108	103	100	99	103	106	108	102	100	100	102	107	109	111	113	119	121	123	80	78	85	81	70	67	75	77	88	72	76	71	67	82	81
70	120	104	84	98	100	102	100	102	103	102	108	108	107	110	108	112	114	116	110	86	77	62	57	54	56	66	67	68	61	60	61	58	62	60
71	112	99	88	92	99	100	102	102	100	102	101	104	106	104	100	108	110	111	114	88	82	72	62	60	58	69	70	70	68	66	66	58	68	67
72	124	112	108	106	102	110	113	102	100	98	96	98	100	104	108	110	116	114	128	78	74	68	68	66	64	66	68	70	70	76	80	79	80	82
73	114	102	86	92	84	96	99	100	102	106	104	109	110	108	112	110	114	112	114	84	80	78	69	63	64	64	62	75	62	63	55	53	63	73
74	127	114	106	104	100	106	110	114	107	104	101	108	113	115	118	120	126	128	131	88	82	80	79	76	72	70	71	70	77	81	77	79	83	79
75	122	106	102	104	100	104	108	111	107	105	102	107	113	115	117	118	118	120	122	86	81	77	74	70	66	81	80	83	80	75	75	74	79	83
76	121	110	102	99	95	101	103	107	102	100	103	104	105	109	113	117	119	121	124	86	80	76	72	69	67	72	80	77	75	75	71	74	69	78
77	118	107	102	99	97	105	107	109	104	100	97	104	109	112	114	117	121	123	125	80	76	82	76	72	76	79	84	88	74	77	79	69	80	83
78	120	108	100	102	100	102	104	107	101	100	101	105	113	115	119	120	126	130	132	82	73	83	72	66	73	81	84	86	79	79	72	74	81	80

S.NO	SBP 0 MINS	SBP 2 MINS	SBP 4 MINS	SBP 6 MINS	SBP 8 MINS	SBP 10 MINS	SBP 12 MINS	SBP 14 MINS	SBP 16 MINS	SBP 18 MINS	SBP 20 MINS	SBP 25 MINS	SBP 30 MINS	SBP 35 MINS	SBP 40 MINS	SBP 45 MINS	SBP 50 MINS	SBP 55 MINS	SBP 60 MINS	PREOP DBP	DBP 0 MINS	DBP 2 MINS	DBP 4 MINS	DBP 6 MINS	DBP 8 MINS	DBP 10 MINS	DBP 12 MINS	DBP 14 MINS	DBP 16 MINS	DBP 18 MINS	DBP 20 MINS	DBP 25 MINS	DBP 30 MINS	DBP 35 MINS
79	105	95	87	92	82	99	86	90	99	100	102	106	108	112	114	116	112	110	118	86	78	71	61	58	54	53	61	64	55	54	59	51	62	69
80	126	110	102	99	96	104	108	110	102	99	97	102	108	112	114	115	118	122	125	86	78	81	82	79	73	81	80	88	78	73	73	69	76	83
81	104	96	85	98	86	90	86	96	98	99	100	102	101	104	108	106	108	111	114	88	71	73	57	58	56	63	68	72	61	54	55	58	63	70
82	112	99	98	99	100	102	101	100	102	103	106	106	108	110	112	112	111	113	115	84	74	77	67	69	63	63	70	78	69	71	69	63	66	77
83	108	93	88	98	100	101	102	102	100	104	108	104	112	114	112	116	114	116	110	86	70	64	64	63	60	60	64	68	56	54	49	54	54	65
84	103	99	86	102	104	104	102	100	106	108	106	108	110	110	110	112	109	108	110	86	72	64	57	64	54	67	71	71	55	56	54	52	58	68
85	125	115	106	100	102	102	104	110	113	110	107	115	119	121	124	125	130	135	137	88	71	70	68	70	70	72	74	78	83	84	80	86	82	80
86	118	102	100	106	102	101	102	104	100	105	107	101	106	110	113	114	119	123	125	82	76	78	69	71	69	77	77	82	71	72	70	72	73	83
87	107	93	88	98	82	99	102	103	104	104	106	104	108	106	110	108	110	112	110	88	79	69	66	56	53	60	60	66	57	61	53	55	60	68
88	113	108	100	92	102	90	104	100	102	102	104	108	106	110	108	110	112	108	110	80	71	66	57	50	50	55	57	62	60	53	55	53	60	61
89	108	92	98	84	102	90	100	102	104	102	104	106	108	109	110	110	108	112	115	84	74	70	62	56	61	62	68	68	64	57	54	56	60	64
90	124	113	105	102	100	108	112	114	106	104	104	108	110	112	115	117	120	125	128	88	78	84	83	79	77	83	80	84	79	82	76	75	77	83

S.NO	DBP 40 MINS	DBP 45 MINS	DBP 50 MINS	DBP 55 MINS	DBP 60 MINS	PREOP MAP	MAP 0 MINS	MAP 2 MINS	MAP 4 MINS	MAP 6MINS	MAP 8 MINS	MAP 10 MINS	MAP 12 MINS	MAP 14 MINS	MAP 16 MINS	MAP 18 MINS	MAP 20 MINS	MAP 25 MINS	MAP 30 MINS	MAP 35 MINS	MAP 40 MINS	MAP 45 MINS	MAP 50 MINS	MAP 55 MINS	MAP 60 MINS	PRE-OP SPO2	SPO2 0 MIN	SPO2 2 MINS	SPO2 4 MINS	SPO2 6 MINS	SPO2 8 MINS	SPO2 10 MINS	SPO2 12 MINS
1	70	68	74	70	72	97	93	89	85	83	79	75	78	67	65	73	75	79	85	85	86	85	90	85	87	98	99	99	99	99	99	99	99
2	54	54	56	60	70	93	93	90	77	70	75	73	67	66	64	65	68	71	77	73	71	72	74	77	85	100	100	100	100	100	100	100	100
3	56	58	56	58	58	83	89	82	83	83	76	73	72	70	72	72	71	78	66	69	69	73	71	71	71	99	100	100	100	100	100	100	100
4	68	74	69	74	84	90	90	78	94	89	89	83	85	83	83	90	84	85	89	86	83	88	84	87	98	100	100	100	100	100	100	100	100
5	58	59	58	60	62	96	75	68	65	67	72	72	75	75	73	74	74	75	75	76	75	77	75	77	77	98	99	99	99	100	100	100	100
6	58	56	64	70	74	87	99	95	95	96	94	98	98	87	89	87	86	85	88	80	72	71	79	85	88	100	100	100	100	100	100	100	100
7	62	64	68	70	68	95	82	82	75	65	71	74	77	79	80	82	77	75	75	73	77	79	83	86	86	98	100	100	100	100	100	100	100
8	66	64	68	62	70	96	97	87	86	83	82	83	86	83	87	84	82	81	83	85	87	84	88	83	89	98	100	99	99	99	99	99	100
9	65	62	62	66	72	91	93	85	72	75	78	79	81	85	85	85	87	86	86	85	82	81	81	84	88	100	99	99	99	99	99	99	99
10	60	62	70	70	70	90	83	82	77	79	81	79	78	77	81	75	77	75	79	81	78	81	87	86	87	98	99	99	99	99	99	98	99
11	80	78	79	82	80	97	96	92	95	95	94	91	92	93	92	90	86	86	87	89	93	93	93	95	96	99	100	99	100	100	100	100	100
12	74	70	71	72	72	93	90	86	88	87	88	83	84	87	86	84	81	76	79	81	85	83	84	84	84	99	100	100	100	100	100	100	100
13	64	66	64	68	68	92	83	78	72	75	78	77	79	81	80	78	74	71	73	76	77	80	79	81	82	99	99	100	100	99	99	99	99
14	70	72	72	74	72	96	47	85	85	86	86	84	87	90	89	83	83	79	81	85	84	84	85	87	85	99	99	99	100	100	100	100	100
15	78	75	77	78	78	92	97	92	95	93	91	89	91	93	93	91	84	79	81	85	89	87	88	90	90	98	99	100	99	100	100	100	100
16	60	56	59	64	60	99	87	81	83	79	79	77	81	83	82	79	77	72	75	77	80	76	77	82	80	98	99	100	99	100	100	100	100
17	70	67	68	70	68	100	87	83	85	84	84	81	84	85	84	80	76	71	75	78	82	80	81	83	82	100	100	99	100	99	99	99	99
18	63	60	63	68	68	93	90	88	91	89	87	85	89	89	89	85	79	76	77	79	82	79	81	84	85	100	99	99	99	99	99	99	99
19	79	75	76	78	76	91	96	92	94	93	95	91	94	95	95	91	85	83	83	87	92	88	88	90	90	100	100	100	100	99	99	99	99
20	68	68	66	68	66	92	92	90	91	92	94	91	91	93	92	91	95	81	85	87	89	88	86	88	85	98	100	100	99	100	100	100	100
21	76	74	75	76	76	97	95	91	92	92	93	90	93	95	93	89	83	80	83	85	89	87	87	88	89	99	100	100	100	100	100	100	100
22	74	71	72	76	74	100	91	86	87	85	86	85	87	88	87	84	80	76	78	81	86	83	82	85	85	98	99	100	100	100	100	100	100
23	63	61	64	68	68	97	86	81	84	83	84	83	85	85	84	81	75	70	70	74	79	77	78	81	82	98	99	100	99	99	99	99	99
24	72	70	70	72	70	88	84	81	83	81	79	79	83	87	85	80	77	73	78	81	84	82	82	85	85	98	99	99	99	99	99	99	99
25	61	58	59	61	59	94	88	83	84	81	79	76	81	84	84	80	77	75	76	79	82	79	79	82	81	100	99	99	99	100	100	100	100
26	59	56	58	59	58	96	89	84	87	83	83	81	85	86	86	83	79	75	75	78	81	78	80	80	81	99	100	99	99	99	99	99	99

S.NO	DBP 40 MINS	DBP 45 MINS	DBP 50 MINS	DBP 55 MINS	DBP 60 MINS	PREOP MAP	MAP 0 MINS	MAP 2 MINS	MAP 4 MINS	MAP 6MINS	MAP 8 MINS	MAP 10 MINS	MAP 12 MINS	MAP 14 MINS	MAP 16 MINS	MAP 18 MINS	MAP 20 MINS	MAP 25 MINS	MAP 30 MINS	MAP 35 MINS	MAP 40 MINS	MAP 45 MINS	MAP 50 MINS	MAP 55 MINS	MAP 60 MINS	PRE-OP SPO2	SPO2 0 MIN	SPO2 2 MINS	SPO2 4 MINS	SPO2 6 MINS	SPO2 8 MINS	SPO2 10 MINS	SPO2 12 MINS
27	61	59	62	63	60	101	88	82	85	82	83	81	81	85	81	77	73	69	73	75	77	75	77	79	77	99	99	99	100	100	100	100	100
28	73	71	74	76	73	94	89	85	88	87	86	86	89	91	91	87	83	81	81	85	90	88	91	93	91	99	100	100	100	100	100	100	100
29	76	74	76	79	76	99	97	92	94	92	91	89	93	93	92	89	85	83	86	88	89	89	89	92	91	98	99	99	99	100	100	100	100
30	86	84	87	88	86	92	89	86	89	88	89	87	88	89	88	87	85	80	83	86	92	90	91	93	92	98	100	99	99	99	99	99	99
31	66	64	63	65	68	97	83	73	69	69	72	75	74	77	78	75	72	72	75	79	79	79	79	80	83	98	99	99	99	99	99	99	99
32	72	68	66	68	70	102	95	86	79	75	79	81	76	79	82	75	72	72	75	76	77	75	75	77	80	99	99	99	99	99	99	99	99
33	81	78	77	80	83	98	91	83	77	78	82	84	81	84	87	81	79	80	85	87	88	87	88	91	94	98	99	99	99	99	99	99	99
34	70	68	66	68	70	94	90	83	76	70	75	75	74	77	81	73	69	68	72	78	79	78	78	80	82	98	99	99	99	99	99	99	99
35	74	71	69	71	72	101	97	87	82	80	84	84	81	83	86	80	77	78	83	87	87	86	87	89	91	100	99	99	99	99	99	99	99
36	69	66	64	66	69	93	81	77	69	64	68	71	67	73	75	69	65	66	72	76	76	75	76	78	81	99	99	99	99	99	99	99	99
37	66	64	62	65	66	91	84	76	71	69	71	72	70	73	76	69	66	66	71	75	75	75	75	79	80	98	100	100	100	100	100	100	100
38	75	72	71	76	77	99	95	88	82	79	84	85	81	87	90	82	78	79	83	87	86	86	86	91	93	100	100	100	100	100	100	100	100
39	76	74	73	78	81	101	100	93	84	80	85	87	84	89	92	84	81	82	87	90	90	89	90	94	97	100	99	99	99	99	99	99	99
40	70	66	65	67	70	98	93	83	79	75	77	83	80	82	87	78	76	76	79	84	85	83	84	86	89	98	99	99	99	99	99	99	99
41	80	77	76	80	83	95	90	85	81	75	79	81	79	83	85	81	82	83	85	89	89	88	87	89	92	100	100	100	100	100	100	100	100
42	76	74	72	76	78	102	91	89	83	81	84	85	83	84	87	82	82	81	85	86	87	86	85	89	91	100	100	100	100	100	100	100	100
43	70	67	66	71	74	101	97	92	84	78	82	83	82	83	87	80	75	76	78	80	81	80	81	85	88	99	99	99	99	99	99	99	99
44	86	83	82	85	86	93	96	87	79	76	80	82	82	86	90	85	85	82	86	91	93	91	91	94	95	99	99	99	99	99	99	99	99
45	82	79	77	80	83	96	90	85	78	80	83	85	85	87	90	85	84	84	87	90	91	89	88	91	92	100	99	99	99	99	99	99	99
46	62	58	56	58	60	100	92	83	75	71	75	78	76	78	81	77	74	74	77	79	79	77	77	79	82	100	99	99	99	99	99	99	99
47	82	80	79	83	86	97	90	84	81	77	79	75	83	83	86	85	83	81	86	88	91	90	88	92	94	100	99	99	99	99	99	99	99
48	67	63	62	66	68	99	90	83	75	73	76	76	74	74	77	72	71	72	75	79	81	79	79	82	84	100	100	100	100	100	100	100	100
49	89	87	86	90	92	95	86	88	81	79	83	86	83	86	89	86	86	84	90	94	95	95	94	96	99	100	99	99	99	99	99	99	99
50	79	76	74	76	78	102	97	90	83	82	87	89	88	89	93	88	86	85	89	93	92	91	90	93	92	100	99	99	99	99	99	99	99
51	79	76	74	76	79	99	92	89	81	79	81	83	82	85	86	81	81	81	83	86	89	87	86	88	91	99	100	100	100	100	100	100	100
52	66	62	61	63	65	99	85	75	69	67	71	73	72	73	76	74	73	73	75	77	80	77	77	79	82	99	100	100	100	100	100	100	100

S.NO	DBP 40 MINS	DBP 45 MINS	DBP 50 MINS	DBP 55 MINS	DBP 60 MINS	PREOP MAP	MAP 0 MINS	MAP 2 MINS	MAP 4 MINS	MAP 6MINS	MAP 8 MINS	MAP 10 MINS	MAP 12 MINS	MAP 14 MINS	MAP 16 MINS	MAP 18 MINS	MAP 20 MINS	MAP 25 MINS	MAP 30 MINS	MAP 35 MINS	MAP 40 MINS	MAP 45 MINS	MAP 50 MINS	MAP 55 MINS	MAP 60 MINS	PRE-OP SPO2	SPO2 0 MIN	SPO2 2 MINS	SPO2 4 MINS	SPO2 6 MINS	SPO2 8 MINS	SPO2 10 MINS	SPO2 12 MINS
53	68	64	62	64	65	99	91	84	79	75	77	79	78	80	83	77	74	73	77	81	82	79	79	81	83	99	100	100	100	100	100	100	100
54	65	61	60	63	65	101	94	83	77	70	74	76	73	79	81	77	76	75	77	79	81	77	77	79	81	98	100	100	100	100	100	100	100
55	78	75	73	75	76	93	91	91	82	80	84	86	85	89	91	89	87	85	87	90	92	89	89	92	93	98	100	100	100	100	100	100	100
56	69	65	64	67	68	93	85	81	74	69	73	75	74	77	81	77	76	75	79	81	83	80	80	83	85	99	100	100	100	100	100	100	100
57	80	77	76	78	80	93	87	81	86	82	86	89	87	88	91	85	84	83	85	91	91	91	89	91	94	98	99	99	99	99	99	99	99
58	81	77	75	80	83	83	82	81	79	72	78	79	79	83	87	82	81	81	85	87	89	87	85	89	92	98	99	99	99	99	99	99	99
59	78	76	74	77	79	91	85	74	78	73	80	83	80	84	87	83	83	81	85	85	87	85	84	87	89	99	100	100	100	100	100	100	100
60	82	78	77	82	85	90	82	77	79	74	80	82	80	83	87	85	83	83	85	89	91	88	88	91	93	99	99	99	99	99	99	99	99
61	85	83	93	84	91	99	89	86	75	79	71	79	84	86	80	85	79	79	86	93	93	93	101	96	101	99	99	99	99	99	99	99	99
62	73	84	77	77	90	100	89	79	75	71	75	82	78	84	80	73	77	76	77	81	84	91	86	88	98	99	99	99	99	99	99	99	99
63	64	69	73	78	79	98	86	78	68	65	67	72	73	78	78	73	73	72	73	79	79	83	84	88	90	99	100	100	100	100	100	100	100
64	97	92	96	97	102	102	99	90	85	81	84	87	90	92	91	89	85	88	92	90	105	103	106	108	112	99	100	100	100	100	100	100	100
65	87	83	83	93	94	99	94	89	79	76	71	82	84	89	82	74	75	77	84	91	95	93	94	102	103	100	100	100	100	100	100	100	100
66	58	61	64	71	72	93	93	80	66	68	67	69	74	77	68	68	67	69	71	75	75	78	81	85	85	99	99	99	99	99	99	99	99
67	93	97	98	106	83	99	90	85	89	92	91	90	93	90	92	88	87	93	96	95	104	107	108	114	100	98	100	100	100	100	100	100	100
68	75	85	79	82	84	93	85	82	75	78	74	76	85	85	78	76	75	78	83	81	86	93	91	93	94	100	99	99	99	99	99	99	99
69	89	91	89	83	78	94	92	93	88	80	78	84	87	95	82	84	81	79	90	90	96	98	99	96	93	99	99	99	99	99	99	99	99
70	68	73	73	76	79	101	91	76	66	69	71	78	78	79	75	74	77	75	77	77	81	86	87	89	89	99	100	100	100	100	100	100	100
71	74	69	69	70	75	101	92	81	71	71	72	79	81	81	79	78	78	73	81	79	83	82	83	84	88	98	99	99	99	99	99	99	99
72	88	86	87	88	86	93	91	83	81	79	77	81	83	81	80	83	85	85	87	89	95	94	97	97	100	99	100	100	100	100	100	100	100
73	67	72	71	79	81	99	91	86	75	73	71	75	74	83	75	77	71	72	79	85	82	85	85	90	92	100	99	99	99	99	99	99	99
74	80	78	80	80	82	101	97	91	88	85	81	82	84	85	87	89	85	89	93	91	93	92	95	96	98	98	100	100	100	100	100	100	100
75	81	84	78	80	81	101	95	87	83	81	77	89	89	92	89	85	84	85	90	94	93	95	91	93	95	98	100	100	100	100	100	100	100
76	83	87	88	87	82	100	94	87	82	79	76	82	88	87	84	83	82	84	81	88	93	97	98	98	96	98	99	99	99	99	99	99	99
77	82	86	80	84	80	97	90	90	85	81	83	88	92	95	84	85	85	81	90	93	93	96	94	97	95	98	100	100	100	100	100	100	100
78	81	86	81	80	86	97	89	91	81	78	82	88	91	93	86	86	82	84	92	92	94	97	96	97	101	100	100	100	100	100	100	100	100

S.NO	DBP 40 MINS	DBP 45 MINS	DBP 50 MINS	DBP 55 MINS	DBP 60 MINS	PREOP MAP	MAP 0 MINS	MAP 2 MINS	MAP 4 MINS	MAP 6MINS	MAP 8 MINS	MAP 10 MINS	MAP 12 MINS	MAP 14 MINS	MAP 16 MINS	MAP 18 MINS	MAP 20 MINS	MAP 25 MINS	MAP 30 MINS	MAP 35 MINS	MAP 40 MINS	MAP 45 MINS	MAP 50 MINS	MAP 55 MINS	MAP 60 MINS	PRE-OP SPO2	SPO2 0 MIN	SPO2 2 MINS	SPO2 4 MINS	SPO2 6 MINS	SPO2 8 MINS	SPO2 10 MINS	SPO2 12 MINS
79	67	66	69	74	77	101	87	79	70	69	63	68	69	73	70	69	73	69	77	83	83	83	83	86	91	98	99	99	99	99	99	99	99
80	75	88	78	76	86	97	94	91	89	86	81	89	89	95	86	82	81	80	87	93	88	97	91	91	99	100	99	99	99	99	99	99	99
81	72	80	78	80	83	100	82	81	66	71	66	72	74	80	73	69	70	73	76	81	84	89	88	90	93	100	99	99	99	99	99	99	99
82	80	76	82	80	82	95	87	84	77	79	75	76	80	85	80	82	81	77	80	88	91	88	92	91	93	100	99	99	99	99	99	99	99
83	68	70	72	74	76	96	83	74	72	75	73	74	77	79	71	71	69	71	73	81	83	85	86	88	87	98	99	99	99	99	99	99	99
84	66	76	74	72	78	99	82	76	67	77	71	79	81	81	72	73	71	71	75	82	81	88	86	84	89	98	100	100	100	100	100	100	100
85	82	78	82	82	84	101	89	85	81	80	81	82	84	89	93	93	89	96	94	94	96	94	98	100	102	99	99	99	99	99	99	99	99
86	80	84	84	86	88	96	90	86	79	83	80	85	85	89	81	83	82	82	84	92	91	94	96	98	100	100	100	100	100	100	100	100	100
87	64	65	69	71	75	100	88	77	73	70	63	73	74	78	73	75	71	71	76	81	79	79	83	85	87	98	99	99	99	99	99	99	99
88	70	75	73	78	78	94	85	80	71	64	67	67	73	75	74	69	71	71	75	77	83	87	86	88	89	99	99	99	99	99	99	99	99
89	69	70	71	76	83	98	85	77	74	65	75	71	79	79	77	72	71	73	76	79	83	83	83	88	94	98	100	100	100	100	100	100	100
90	84	80	81	86	86	102	93	94	90	87	85	91	91	94	88	89	85	86	88	93	94	92	94	99	100	100	100	100	100	100	100	100	100

S.NO	SPO2 14 MINS	SPO2 16 MINS	SPO2 18 MINS	SPO2 20 MINS	SPO2 25 MINS	SPO2 30 MINS	SPO2 35 MINS	SPO2 40 MINS	SPO2 45 MINS	SPO2 50 MINS	SPO2 55 MINS	SPO2 60 MINS	TIME FROM SPINAL TO DELIVERY	TIME FROM DELIVERY TO END	DURATION OF SURGERY	MAXIMUM SENSORY BLOCK HEIGHT	TIME FOR MAXIMUM SENSORY BLOCK	HYPOTENSION	NAUSEA	VOMITTING	EPHEDRINE
1	99	99	99	99	99	99	99	99	99	99	99	99	8	42	50	T4	3	ABSENT	ABSENT	ABSENT	NIL
2	100	100	100	100	100	100	100	100	100	100	100	100	8	44	52	T4	4	ABSENT	ABSENT	ABSENT	NIL
3	100	100	100	100	100	100	100	100	98	100	100	100	8	40	48	T5	4	ABSENT	ABSENT	ABSENT	NIL
4	100	100	100	100	100	99	99	99	100	100	100	100	7	41	48	T4	3	ABSENT	ABSENT	ABSENT	NIL
5	100	100	100	100	100	100	100	100	100	100	100	100	7	39	46	T5	3	**PRESENT**	**PRESENT**	ABSENT	**6mg**
6	100	100	100	100	100	100	100	100	100	100	100	100	7	39	46	T5	3	ABSENT	ABSENT	ABSENT	NIL
7	100	100	100	100	100	100	100	100	100	100	100	100	6	46	52	T6	2	PRESENT	ABSENT	ABSENT	**6mg**
8	100	100	100	100	100	100	100	100	100	100	100	100	8	35	43	T5	4	ABSENT	ABSENT	ABSENT	NIL
9	99	99	99	99	99	99	99	99	99	99	99	99	8	37	45	T5	4	ABSENT	ABSENT	ABSENT	NIL
10	99	99	99	99	99	99	99	99	99	99	99	99	6	42	48	T4	2	ABSENT	ABSENT	ABSENT	NIL
11	100	100	100	100	100	100	100	100	100	100	100	100	7	44	51	T6	3	ABSENT	ABSENT	ABSENT	NIL
12	100	100	100	100	100	100	100	100	100	100	100	100	8	42	50	T5	4	ABSENT	ABSENT	ABSENT	NIL
13	99	99	99	99	99	99	99	99	99	99	99	99	7	41	48	T5	3	**PRESENT**	ABSENT	ABSENT	**6mg**
14	100	100	100	100	100	100	100	100	100	100	100	100	7	41	48	T6	3	ABSENT	ABSENT	ABSENT	NIL
15	100	100	100	100	100	100	100	100	100	100	100	100	8	38	46	T5	4	ABSENT	ABSENT	ABSENT	NIL
16	100	100	100	100	100	100	100	100	100	100	100	100	7	37	44	T5	3	ABSENT	ABSENT	ABSENT	NIL
17	99	99	99	99	99	99	99	99	99	99	99	99	8	44	52	T6	4	ABSENT	ABSENT	ABSENT	NIL
18	99	99	99	99	99	99	99	99	99	99	99	99	6	42	48	T5	2	ABSENT	ABSENT	ABSENT	NIL
19	99	99	99	99	99	99	99	99	99	99	99	99	8	36	44	T6	4	ABSENT	ABSENT	ABSENT	NIL
20	100	100	100	100	100	100	100	100	100	100	100	100	8	42	50	T6	4	ABSENT	ABSENT	ABSENT	NIL
21	100	100	100	100	100	100	100	100	100	100	100	100	8	42	50	T6	4	ABSENT	ABSENT	ABSENT	NIL
22	100	100	100	100	100	100	100	100	100	100	100	100	6	43	49	T5	2	ABSENT	ABSENT	ABSENT	NIL
23	99	99	99	99	99	99	99	99	99	99	99	99	6	45	51	T5	2	ABSENT	ABSENT	ABSENT	NIL
24	99	99	99	99	99	99	99	99	99	99	99	99	6	39	45	T4	2	ABSENT	ABSENT	ABSENT	NIL
25	100	100	100	100	100	100	100	100	100	100	100	100	6	38	44	T6	2	ABSENT	ABSENT	ABSENT	NIL
26	99	99	99	99	99	99	99	99	99	99	99	99	8	39	47	T6	4	ABSENT	ABSENT	ABSENT	NIL

S.NO	SPO2 14 MINS	SPO2 16 MINS	SPO2 18 MINS	SPO2 20 MINS	SPO2 25 MINS	SPO2 30 MINS	SPO2 35 MINS	SPO2 40 MINS	SPO2 45 MINS	SPO2 50 MINS	SPO2 55 MINS	SPO2 60 MINS	TIME FROM SPINAL TO DELIVERY	TIME FROM DELIVERY TO END	DURATION OF SURGERY	MAXIMUM SENSORY BLOCK HEIGHT	TIME FOR MAXIMUM SENSORY BLOCK	HYPOTENSION	NAUSEA	VOMITTING	EPHEDRINE
27	100	100	100	100	100	100	100	100	100	100	100	100	7	41	48	T5	3	ABSENT	ABSENT	ABSENT	NIL
28	100	100	100	100	100	100	100	100	100	100	100	100	6	40	46	T6	2	ABSENT	ABSENT	ABSENT	NIL
29	100	100	100	100	100	100	100	100	100	100	100	100	7	40	47	T6	3	ABSENT	ABSENT	ABSENT	NIL
30	99	99	99	99	99	99	99	99	99	99	99	99	8	36	44	T6	4	ABSENT	ABSENT	ABSENT	NIL
31	99	99	99	99	99	99	99	99	99	99	99	99	7	39	46	T4	3	ABSENT	ABSENT	ABSENT	NIL
32	99	99	99	99	99	99	99	99	99	99	99	99	8	41	49	T5	4	ABSENT	ABSENT	ABSENT	NIL
33	99	99	99	99	99	99	99	99	99	99	99	99	8	46	54	T5	4	**PRESENT**	ABSENT	ABSENT	**6mg**
34	99	99	99	99	99	99	99	99	99	99	99	99	7	41	48	T6	3	ABSENT	ABSENT	ABSENT	NIL
35	99	99	99	99	99	99	99	99	99	99	99	99	7	44	51	T6	3	ABSENT	ABSENT	ABSENT	NIL
36	99	99	99	99	99	99	99	99	99	99	99	99	7	47	54	T6	2	**PRESENT**	ABSENT	ABSENT	**6mg**
37	100	100	100	100	100	100	100	100	100	100	100	100	7	41	48	T6	2	ABSENT	ABSENT	ABSENT	NIL
38	100	100	100	100	100	100	100	100	100	100	100	100	7	41	48	T6	3	ABSENT	ABSENT	ABSENT	NIL
39	99	99	99	99	99	99	99	99	99	99	99	99	8	46	54	T5	4	ABSENT	ABSENT	ABSENT	NIL
40	99	99	99	99	99	99	99	99	99	99	99	99	7	46	53	T5	3	ABSENT	ABSENT	ABSENT	NIL
41	100	100	100	100	100	100	100	100	100	100	100	100	7	38	45	T4	3	**PRESENT**	ABSENT	ABSENT	**6mg**
42	100	100	100	100	100	100	100	100	100	100	100	100	6	40	46	T5	2	ABSENT	ABSENT	ABSENT	NIL
43	99	99	99	99	99	99	99	99	99	99	99	99	7	43	50	T5	3	ABSENT	ABSENT	ABSENT	NIL
44	99	99	99	99	99	99	99	99	99	99	99	99	6	46	52	T5	2	ABSENT	ABSENT	ABSENT	NIL
45	99	99	99	99	99	99	99	99	99	99	99	99	7	39	46	T5	4	**PRESENT**	ABSENT	ABSENT	**6mg**
46	99	99	99	99	99	99	99	99	99	99	99	99	8	37	45	T4	4	ABSENT	ABSENT	ABSENT	NIL
47	99	99	99	99	99	99	99	99	99	99	99	99	8	44	52	T6	4	ABSENT	ABSENT	ABSENT	NIL
48	100	100	100	100	100	100	99	99	99	99	99	99	8	40	48	T6	4	ABSENT	ABSENT	ABSENT	NIL
49	99	99	99	99	99	99	99	99	99	99	99	99	8	36	44	T5	4	**PRESENT**	ABSENT	ABSENT	**6 mg**
50	99	99	99	99	99	99	99	99	99	99	99	99	7	41	48	T6	3	ABSENT	ABSENT	ABSENT	NIL
51	100	100	100	100	100	100	100	100	100	100	100	100	8	42	50	T5	4	ABSENT	ABSENT	ABSENT	NIL
52	100	100	100	100	100	100	100	100	100	100	100	100	7	46	53	T5	3	ABSENT	ABSENT	ABSENT	NIL

S.NO	SPO2 14 MINS	SPO2 16 MINS	SPO2 18 MINS	SPO2 20 MINS	SPO2 25 MINS	SPO2 30 MINS	SPO2 35 MINS	SPO2 40 MINS	SPO2 45 MINS	SPO2 50 MINS	SPO2 55 MINS	SPO2 60 MINS	TIME FROM SPINAL TO DELIVERY	TIME FROM DELIVERY TO END	DURATION OF SURGERY	MAXIMUM SENSORY BLOCK HEIGHT	TIME FOR MAXIMUM SENSORY BLOCK	HYPOTENSION	NAUSEA	VOMITTING	EPHEDRINE
53	100	100	100	100	100	100	100	100	100	100	100	100	7	37	44	T4	3	ABSENT	ABSENT	ABSENT	NIL
54	100	100	100	100	100	100	100	100	100	100	100	100	7	45	52	T4	3	**PRESENT**	ABSENT	ABSENT	**6mg**
55	100	100	100	100	100	100	100	100	100	100	100	100	7	47	54	T5	3	ABSENT	ABSENT	ABSENT	NIL
56	100	100	100	100	100	100	100	100	100	100	100	100	6	39	45	T5	2	**PRESENT**	**PRESENT**	ABSENT	**6+6mg**
57	99	99	99	99	99	99	99	99	99	99	99	99	8	45	53	T5	4	ABSENT	ABSENT	ABSENT	NIL
58	99	99	99	99	99	99	99	99	99	99	99	99	6	48	54	T6	2	**PRESENT**	**PRESENT**	ABSENT	**6+6mg**
59	100	100	100	100	100	100	100	100	100	100	100	100	8	34	42	T5	4	**PRESENT**	ABSENT	ABSENT	**6+6mg**
60	99	99	99	99	99	99	99	99	99	99	99	99	7	38	45	T5	3	**PRESENT**	ABSENT	ABSENT	**6mg**
61	99	99	99	99	99	99	99	99	99	99	99	99	7	40	47	T4	3	**PRESENT**	ABSENT	ABSENT	**6+6mg**
62	99	99	99	99	99	99	99	99	99	99	99	99	7	38	45	T5	3	**PRESENT**	ABSENT	ABSENT	**6mg**
63	100	100	100	100	100	100	100	100	100	100	100	100	8	36	44	T5	4	**PRESENT**	**PRESENT**	ABSENT	**6+6mg**
64	100	100	100	100	100	100	100	100	100	100	100	100	6	42	48	T5	2	ABSENT	ABSENT	ABSENT	NIL
65	100	100	100	100	100	100	100	100	100	100	100	100	8	41	49	T6	4	ABSENT	ABSENT	ABSENT	NIL
66	99	99	99	99	99	99	99	99	99	99	99	99	8	43	51	T6	4	**PRESENT**	ABSENT	ABSENT	**6mg**
67	100	100	100	100	100	100	100	100	100	100	100	100	7	41	48	T6	3	ABSENT	ABSENT	ABSENT	NIL
68	99	99	99	99	99	99	99	99	99	99	99	99	8	38	46	T6	4	**PRESENT**	ABSENT	ABSENT	**6mg**
69	99	99	99	99	99	99	99	99	99	99	99	99	8	44	52	T4	4	ABSENT	ABSENT	ABSENT	NIL
70	100	100	100	100	100	100	100	100	100	100	100	100	7	40	47	T4	3	**PRESENT**	ABSENT	ABSENT	**6mg**
71	99	99	99	99	99	99	99	99	99	99	99	99	7	42	49	T6	3	**PRESENT**	ABSENT	ABSENT	**6mg**
72	100	100	100	100	100	100	100	100	100	100	100	100	7	38	45	T5	3	ABSENT	ABSENT	ABSENT	NIL
73	99	99	99	99	99	99	99	99	99	99	99	99	8	47	55	T6	4	**PRESENT**	**PRESENT**	ABSENT	**6+6mg**
74	100	100	100	100	100	100	100	100	100	100	100	100	7	36	43	T5	3	ABSENT	ABSENT	ABSENT	NIL
75	100	100	100	100	100	100	100	100	100	100	100	100	8	38	46	T5	4	ABSENT	ABSENT	ABSENT	NIL
76	99	99	99	99	99	99	99	99	99	99	99	99	7	42	49	T6	3	ABSENT	ABSENT	ABSENT	NIL
77	100	100	100	100	100	100	100	100	100	100	100	100	7	38	45	T4	3	ABSENT	ABSENT	ABSENT	NIL
78	100	100	100	100	100	100	100	100	100	100	100	100	7	45	52	T6	3	ABSENT	ABSENT	ABSENT	NIL

S.NO	SPO2 14 MINS	SPO2 16 MINS	SPO2 18 MINS	SPO2 20 MINS	SPO2 25 MINS	SPO2 30 MINS	SPO2 35 MINS	SPO2 40 MINS	SPO2 45 MINS	SPO2 50 MINS	SPO2 55 MINS	SPO2 60 MINS	TIME FROM SPINAL TO DELIVERY	TIME FROM DELIVERY TO END	DURATION OF SURGERY	MAXIMUM SENSORY BLOCK HEIGHT	TIME FOR MAXIMUM SENSORY BLOCK	HYPOTENSION	NAUSEA	VOMITTING	EPHEDRINE
79	99	99	99	99	99	99	99	99	99	99	99	99	7	38	45	T6	3	**PRESENT**	**PRESENT**	ABSENT	**6+6+6mg**
80	99	99	99	99	99	99	99	99	99	99	99	99	7	38	45	T5	3	ABSENT	ABSENT	ABSENT	NIL
81	99	99	99	99	99	99	99	99	99	99	99	99	7	41	48	T6	3	**PRESENT**	**PRESENT**	**PRESENT**	**6+6+6+6mg**
82	99	99	99	99	99	99	99	99	99	99	99	99	7	45	52	T5	3	ABSENT	ABSENT	ABSENT	NIL
83	99	99	99	99	99	99	99	99	99	99	99	99	7	44	51	T4	3	**PRESENT**	ABSENT	ABSENT	**6mg**
84	100	100	100	100	100	100	100	100	100	100	100	100	7	38	45	T5	3	**PRESENT**	ABSENT	ABSENT	**6mg**
85	99	99	99	99	99	99	99	99	99	99	99	99	7	38	45	T5	3	ABSENT	ABSENT	ABSENT	NIL
86	100	100	100	100	100	100	100	100	100	100	100	100	7	43	50	T4	3	ABSENT	ABSENT	ABSENT	NIL
87	99	99	99	99	99	99	99	99	99	99	99	99	7	43	50	T6	3	**PRESENT**	ABSENT	ABSENT	**6+6mg**
88	99	99	99	99	99	99	99	99	99	99	99	99	8	40	48	T6	4	**PRESENT**	ABSENT	ABSENT	**6+6mg**
89	100	100	100	100	100	100	100	100	100	100	100	100	8	42	50	T6	4	**PRESENT**	**PRESENT**	**PRESENT**	**6+6+6mg**
90	100	100	100	100	100	100	100	100	100	100	100	100	7	40	47	T6	3	ABSENT	ABSENT	ABSENT	NIL

CONSENT FORM

I _____ hereby give consent to participate in the study conducted by **DR. N.SARANYA DEVI** post graduate in department of Anaesthesiology ,Thanjavur medical college & hospital, Thanjavur and to use my personal clinical data and result of investigation for the purpose of analysis and to study the nature of disease. I also give consent for further investigations

Place :

Date : Signature of participant

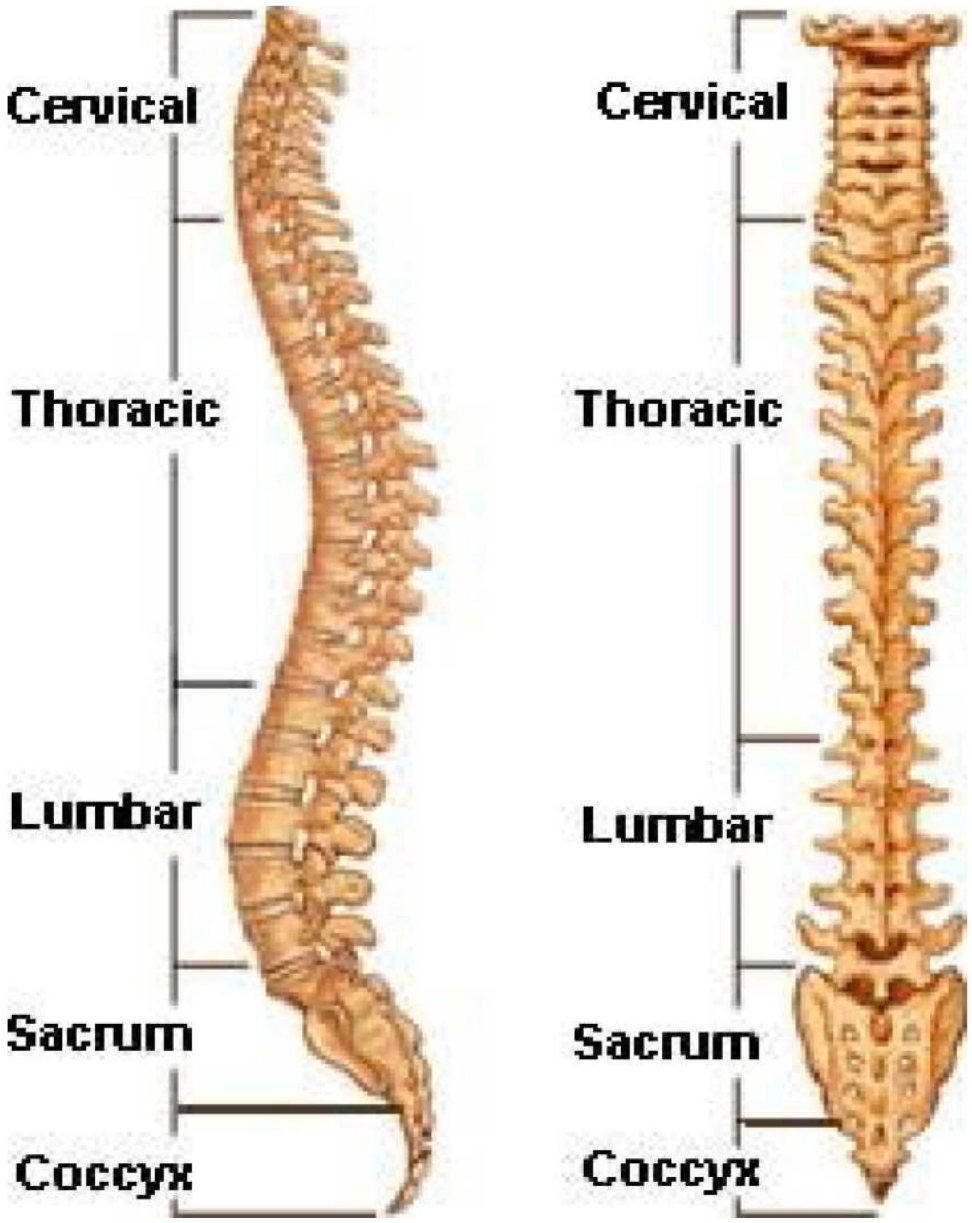

FIGURE 1. VERTEBRAL COLUMN

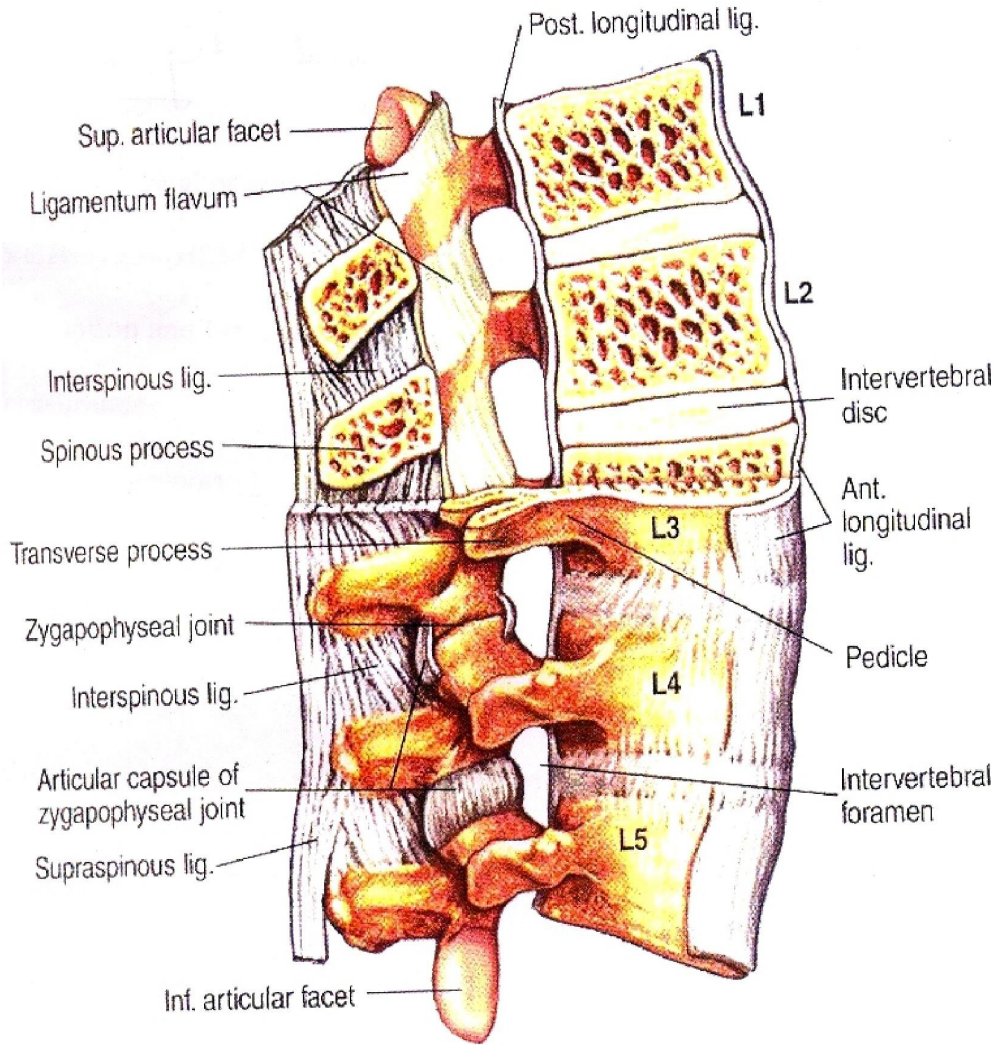

FIGURE 2: VERTEBRAL LIGAMENTS

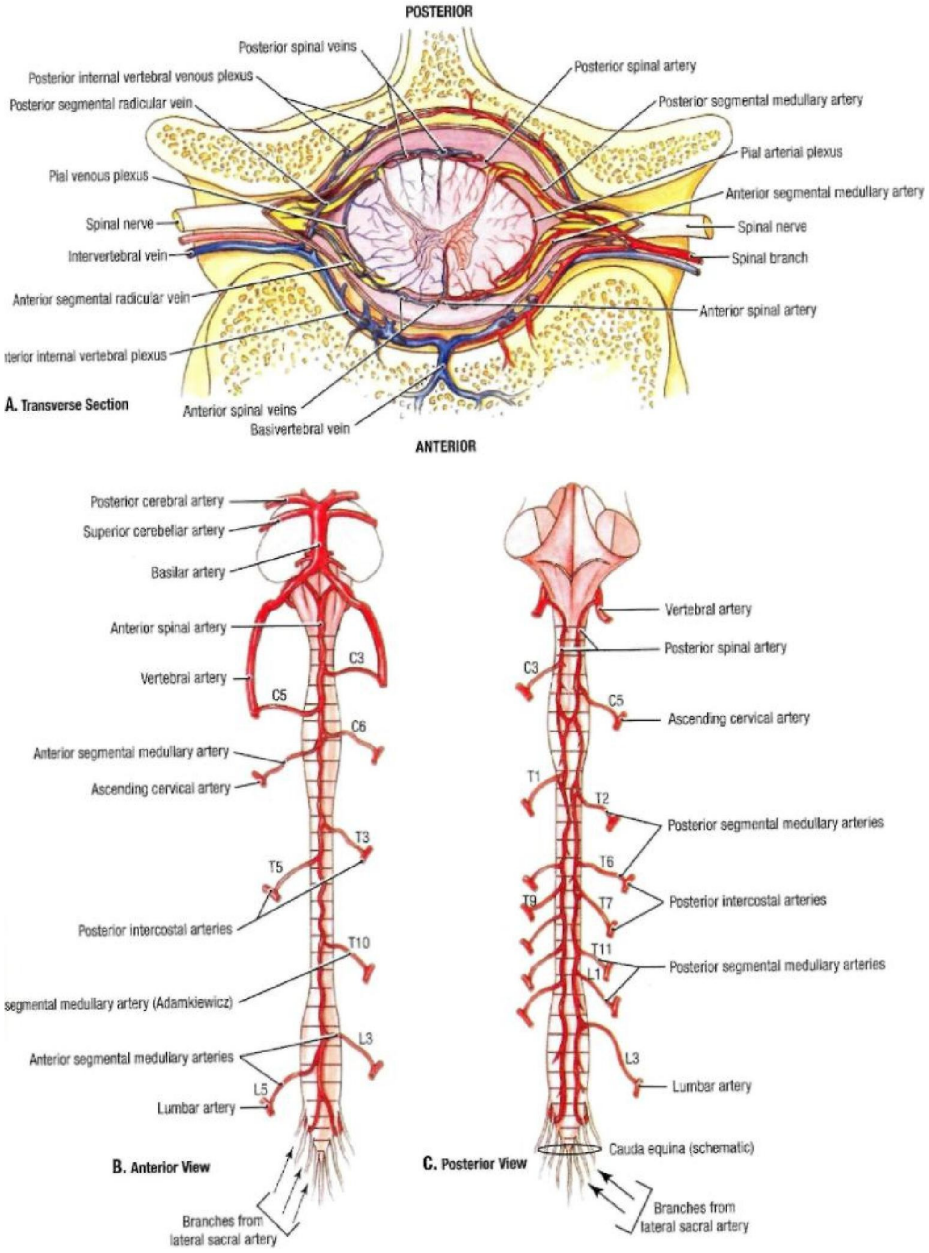

FIGURE 3: BLOOD SUPPLY OF SPINAL CORD

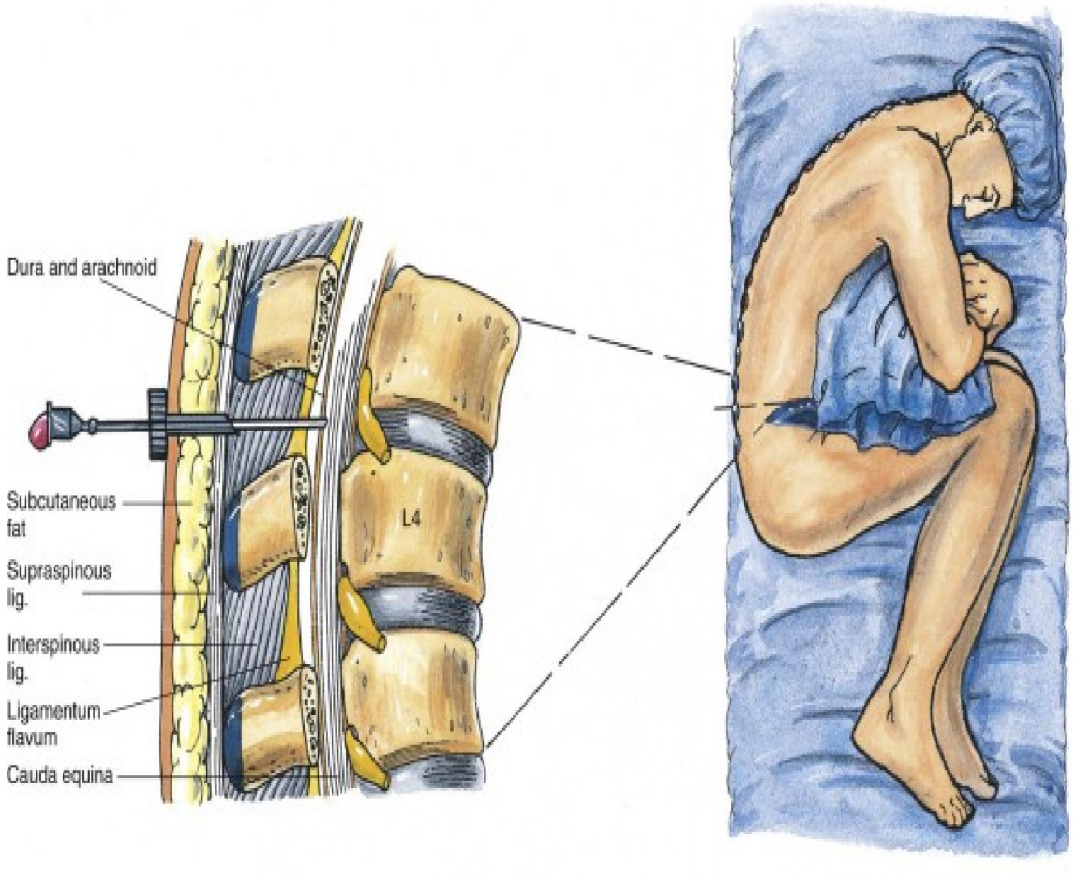

FIGURE 4: STRUCTURES PIERCED TO REACH SUBARACHNOID SPACE